



Low-Cost Solar Retrofit Project

Financing Options for Residential Solar Photovoltaics (PV) & Energy Efficiency

November 2013

For

Itron, Inc., Program Manager
California Solar Initiative
Research, Development & Demonstration
Solicitation #2

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Executive Summary

Effective financing is unarguably responsible for much of the recent explosive growth in energy efficiency and, in particular, the solar photovoltaic (PV) product markets. According to the Solar Energy Industries Association, average solar PV system prices have declined by 40-percent since the beginning of 2011 – and by more than 50-percent since the beginning of 2010. New leasing programs that take advantage of this dramatic drop in costs are proliferating at astonishing rates. In some States such as California and Colorado, third party companies that lease the solar PV equipment directly to the homeowner are responsible for more than 90-percent of quarterly sales. This trend is expected to continue well into 2014.¹ While not as steep as recent PV market growth, the energy efficiency markets are strong as well, thanks in part to new infrastructure put in place through Stimulus Funding since 2009, the relative high visibility of state and local energy efficiency programs and policies, and a very aggressive U.S. energy services industry.

This report identifies and reviews traditional energy efficiency financing and more recent innovative third party solar PV financing mechanisms and related loan programs that help move the market toward Zero Net Energy (ZNE) goals. Specifically, the authors identify financing program options that integrate financing for the re-roof with PV and energy efficiency improvements that are simple to apply and qualify for, have a competitive interest rate and low up-front costs. Programs that finance the re-roof and the solar PV along with efficiency upgrades are especially important, since comprehensive retrofits are one very effective way to get to ZNE goals.

Key Concepts to Consider in Energy-Efficiency and PV Retrofits

While performing the research for this report, a number of key concepts emerged regarding residential energy efficiency and PV retrofits, how to evaluate the costs and benefits of the various options, and identifying and evaluating the various financial vehicles that would . When evaluating different options for financing energy efficiency and solar PV, the authors believe the following key concepts should be considered²:

- The long term costs and benefits that will accrue over the entire lifecycle of a system or equipment being evaluated
- Take advantage of a home energy inspection to provide key data for making energy improvement decisions, and request the following results from the inspection for evaluating the investments from the possible improvements:
 - Energy efficiency improvements, in order of cost-effectiveness, tailored to the home

¹ Regulatory Assistance Project, presentation to the Colorado Energy Office, October 28, 2013.

² These key concepts are listed again in the conclusions section

- Potential saving from the improvements
 - Potential costs of the improvements
 - Economic analyses of packages of features, including cash-flow and/or lifecycle cost analyses
- Include direct and indirect benefits in the cost-effectiveness analyses
 - Consider not only the energy and cost savings, but also the improvements in household comfort with energy efficiency and reliability improvements that result from the addition of the efficiency improvements and the PV
- Leverage energy efficiency and solar PV retrofits to achieve multiple goals
 - Determine the goals of the retrofit before obtaining a financing product
 - Goals can include: cost savings, energy independence, improved energy reliability, paying off personal debt; obtaining sustainable, whole-house comfort; minimizing home maintenance requirements; air quality improvement and climate mitigation.
- Consult with local lenders and review energy efficiency and solar PV retrofit financing programs
- Know that both the energy efficiency and solar PV equipment have limited, predictable and often different lifespans
 - Be prepared for potential systems failures (e.g., furnaces, water heaters, etc.) by knowing the typical life of important equipment³
 - Store and use this information as a triggering event to simultaneously:
 - Replace old, inefficient systems that are at the end of their useful lives
 - Hire a home energy rater before the equipment fails to garner information needed to do timely efficiency and solar PV upgrades, optimizing time, and energy and bill savings, and minimizing inconveniences
- Know that low interest rates are currently, but not permanently available through financing products which may require more paperwork and longer processing times
- Know that making multiple upgrades at the same time is almost always more cost-effective than making them separately:
 - Consider at least all of the upgrades that will result in a neutral cash flow (where monthly payments for improvements at least equal the monthly utility savings).
- Keep in mind that the home value should increase after an energy efficient retrofit and solar PV installation
 - Obtain an energy efficient home value appraisal from an appraiser certified under National Appraisal Institute as a “green” appraiser to ensure the appraisal properly includes efficiency and PV upgrades.

³ NREL’s lifecycle database for the expected operable life of various building system:
<http://www.nrel.gov/lci/database/default.asp>

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Abbreviations and Acronyms

AMI	Area Median Income
ARRA	American Recovery and Reinvestment Act of 2009
BPI	Building Performance Institute
CEAD	Clean Energy Assessment District
CEQ	White House Council on Environmental Quality
DEER	Database for Energy Efficient Resources
DOE	U.S. Department of Energy
DSIRE	Database of State Incentives for Renewables & Efficiency
DTI	Debt to Income
EE	Energy Efficiency
EECBG	Energy Efficiency and Conservation Block Grant
EEM	Energy Efficient Mortgage
EIM	Energy Improvement Mortgage
EGIA	Electric & Gas Industries Association
ESCO	Energy Service Company
Fannie Mae	Federal National Mortgage Association (FNMA)
FI	Financial Institution
FICO	Fair Isaac Corporation (a credit rating agency)
FHA	Federal Housing Authority
Freddie Mac	Federal Home Loan Mortgage Corporation (FHLMC)
GHG	Greenhouse Gas
HELOC	Home Equity Line of Credit
HPwES	Home Performance with <i>Energy Star</i>
HUD	U.S. Department of Housing and Urban Development
ICLEI	International Council for Local Environmental Initiatives – Local Governments for Sustainability
LEED	Leadership in Energy and Environmental Design
LCC	Life Cycle Cost
OBf	On-Bill Financing
OEM	Office of Energy Management
PG&E	Pacific Gas & Electric
PACE	Property-Assessed Clean Energy
PPA	Power Purchase Agreement
PV	Photovoltaic
RESNET	Residential Energy Services Network
ZNE	Zero Net-Energy ⁴

⁴ A ZNE building optimizes energy-efficiency and on-site renewable generation so that, on a net, annual basis the building generates as much energy from the on-site renewables (PVs) as it consumes.

Introduction

Effective financing is unarguably responsible for much of the recent explosive growth in energy efficiency and solar photovoltaic (PV) product markets. For example, the solar photovoltaic market has grown by 40-percent each year since 2008, and 77%⁵ of this new market growth is served by third-party leasing companies in California, and in some States, such as Colorado the third-party leases make up 95% of the new market entries. These leasing arrangements were not profitable until recently⁶, and some have sacrificed current profit for market share.. Leasing companies found how to finance PV and make a decent return on their investment, and have literally changed the market overnight. This is but one example of something that is occurring across the country, and across technologies.

This report discusses leasing and various other financing options – including programs, mechanisms and business models that can be used to finance the cost of residential solar photovoltaic (PV) installation, energy efficiency improvements, and re-roofing and other basic home maintenance and repairs, for the homeowner. The large upfront cost and lack of appropriate and easy options for financing these costs are well-documented deterrents for large scale adoption and market penetration of high energy efficiency and solar PV installations in existing and new homes in the United States.

For the solar PV, re-roofing and energy efficient product markets to continue to grow, and grow as a group, financing vehicles need to evolve to the point where average consumers can participate in the loans versus those few with exceptional credit histories and significant cash in the bank. The solar and banking industries are attempting to address this issue through many of the programs highlighted in this report.

The structure of this report is: first discuss some of the situations that result in homeowners financing repairs, energy-efficiency improvements and/or PVs, and different financing methods used in these different situations; Second, identify and discuss the various financing options available to homeowners under these different situations. The second section includes an analysis of the advantages and disadvantages of the major methods to finance energy efficiency and or PVs, and some potential changes to the financing tools and processes that could help increase market absorption of energy-efficiency and/or PVs. Third, explore how best to integrate the efficiency and PV needed to dramatically reduce energy use in California's very large existing homes market, and the financing options, tools, and vehicles that could help drive widespread adoption of energy

⁵ Climate Policy Initiative, Andy Colthorpe: 29 July 2013

⁶ Regulatory Assistance Project, John Shenot presentation to the Colorado Energy Office PV/Discussion Group, Denver, Colorado, October 28, 2013.

efficiency and PV retrofits in California, potentially even reaching high frequencies of ZNE homes in the California residential market.

There are a number of financial mechanisms, options and incentives available to finance different aspects of ZNE homes (efficiency and renewables), in different market segments (new, existing, owner-occupied, leased, rental), as well as different paths for homeowners to improve their homes and reach ZNE (new construction, retrofit, remodeling, renovations, etc.). This report identifies existing options for homeowners to finance efficiency and/or renewables and the current financing gaps or barriers to financing each or both efficiency improvements and renewables, in the different market segments, as well as opportunities and recommendations for developing new financing options based upon the existing options and their gaps.

The research and the results have been organized into two main sections, followed by Conclusions:

A. Existing Financing Options and Solutions

B. Financing Gaps & Opportunities

C. Conclusions

Factors Influencing Financing Energy Efficiency and / or PV Home Improvements

This section provides an overview of common situations needing financing, and shortfalls common financing options have in today's residential market, when the financing could include energy-efficiency and/or renewable energy improvements. Homeowners can find it difficult to finance the costs of home improvements, including energy efficiency, PVs or both, as well as home repairs and other types of home improvement projects. The type of home improvement will generally dictate the type of financing available and/or used for that purpose. In addition, home improvements can occur under different circumstances that will also impact the type of financing that might be used. Financing energy efficiency and PV improvements is also critical to any policy goals that could lead to ZNE retrofits.

In the context of this document, the pertinent financing options are for retrofitting homes with improved energy-efficiency measures/features, and installing rooftop PVs. These home improvements may or may not be sufficient to reach ZNE; ZNE does not provide a market distinction that impacts the value of the home; therefore, for this analysis and discussion, qualifying as ZNE is not currently pertinent to the financing of any improvements. This is likely to change at some point in the future, when energy-efficiency policies have changed the residential market sufficiently that ZNE or, more likely a HERS rating and efficiency upgrade report (whether

targeting ZNE or not) would be viewed as useful information by lenders. For instance, a homeowner planning a retrofit their home to do a deep retrofit, whether or nor they strive for a ZNE designation, would have a HERS inspection and rating done that would include consultation and recommendations for efficiency improvements. The HERS report would document the current status of the home, in terms of energy efficiency, as well as the planned improvements. The information in the HERS report regarding planned installation of energy-efficiency features would include costs, predicted energy-savings and utility costs savings for both individual features and the recommended package of features. In the future, the documentation in such a HERS rating would be meaningful and useful to a lender, such that the lender would extract from the HERS documents the expected monthly utility costs savings, which would be treated as additional income. This would help qualify the homeowner for a home improvement loan to finance energy-efficiency and/or renewable energy improvements. While this can be done today, it is not common financing practice. Currently, financing products are available for home maintenance and repair, home improvements and/or additions, energy-efficiency retrofits, and PV retrofits. However, current financing products generally do not combine these home improvements. The following examples are to illustrate some different situations leading to repairs and/or improvements to the home, that lead to very different financing vehicles for these situations. It is quite possible that two or all three improvements could be needed or desired all simultaneously, however, it is unlikely that they would all be financed together, and even using different funding sources. In Section A of this report different financing vehicles will be discussed, including under what circumstances the loans are available and/or appropriate.

- a. Basic Home Maintenance and Repair
- b. Retrofit to Improve Energy Efficiency
- c. Rooftop PV Installation

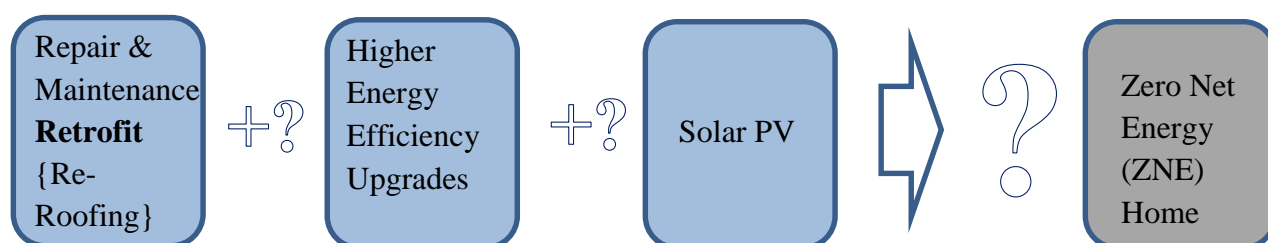


Figure 1. Financing Goals Leading to Target ZNE Home – or not?

a. Basic Home Maintenance and Repair, such as Re-roofing

In this example, an essential piece of home equipment or structure such as the roof fails suddenly (due to hail or water damage, for example) and requires immediate replacement. The urgency of the replacement may mean that a homeowner has little time for exploring this event as an opportunity

to not only replace or repair the roof, but to add PVs and/or efficiency, such as insulation under the new roof or increased attic insulation, or a cool roof, or any of a large number of efficiency improvements that could be part of, or in addition to a re-roof. But this takes time for the homeowner to gather information regarding what to do, and will result in a more complicated and longer financing application process than simply financing a new roof, potentially through the roofing company. For this homeowner, a short turnaround time for loan processing is critical, and will not likely involve either assessing the value of the home, nor the potential for improvements on the home. Rather, the homeowner will more likely take an unsecured loans (the house is not used as collateral), based on the homeowner's personal finances, and the lender or roofer keeping the loan value small.

b. Retrofit to Improve Energy Efficiency

Installing or upgrading the energy efficiency features and/or equipment in one's home is generally a decision made out of choice rather than necessity as in the example of roof damage. For instance, a homeowner might chose to increase insulation levels, replace old leaky windows, replace functioning furnace, air conditioner, and water heater with a new ones of substantially greater efficiency, and replace the duct system with one that is air tight and higher insulation. Their motivations might be reduced energy bills and improved comfort. The homeowner's understanding of these home improvements and their benefits might be the result of a utility incentive program, a statewide energy-efficiency marketing campaign, their own research, or word of mouth. Regardless of the genesis of the homeowner's motivation they will discover that retrofitting their home with a package of efficiency measures to produce significant energy savings will require a significant initial investment, but that the combination of improvements could be chosen such that it will pay for itself through *positive cash flow* directly due to the improvements. *Positive cash flow* means that the increase in monthly **cash paid out** by the homeowner on a loan for the efficiency improvements to their home is **less than the monthly cash saved** due to reduced energy bills, resulting in a net monthly savings. In this example, the homeowner will likely look for a home improvement loan to finance the efficiency improvements. This could be a total or partial ("second") refinance of the home, with the home as collateral, and requiring appraisals and homeowner qualification for the loan; this type of loan takes significant time (and effort) to put in place. Alternatively, the utility may have an energy-efficiency program that finances the efficiency improvements, and adds the financing costs to the monthly utility bill – thus the homeowner does not see a change in their monthly bills, but has improved their home and comfort. In addition, when the appraisal is performed at sale or for refinance, the appraiser should be certified as a Green Appraiser by the National Appraisal Institute to ensure that the energy-efficiency improvements are incorporated into the value calculations, because they will increase the appraised value of the home, if appraised correctly.

c. Solar PV Installation

The roof-mounted solar PV arrays are essential for a home to be designated as a ZNEhome. Until quite recently, the upfront cost for a solar PV system has been high, often with long pay-back periods and negative cash-flow. This has been one of the biggest deterrents for large scale adoption of residential PVs. However, recently PV module costs have plummeted, and with improvements in the balance of system and installation processes and procedures, the total systems costs have reduced substantially. These reduced installed PV systems costs, coupled with rising electricity costs, have increased the cost-effectiveness of PVs, improved the likelihood of positive cash flow, particularly in California, with its relatively high utility rates. Good home energy management coupled with utility Time Of Use rates in California provides a very good opportunity for PVs to be a good investment, both providing positive cash flow and increasing the value and sales cost⁷ of the home. Nonetheless, consumers continue to seem to have difficulty understanding or accepting economic sales arguments, including positive cash flow, and, given that there is a significant cost to finance a PV installation⁸, most homeowners remain reticent to make the upfront investment and need attractive financing options to install the solar PV system. However, in the last few years, with the decreases in costs and some very innovative financing programs, while still holding a very small residential market share, even in California, PV systems have dramatically increased their market share. The combination of energy-efficiency improvements plus PVs will likely produce the most cost-effective method to dramatically reduce energy use and corresponding costs. However, there are innovative financing and/or purchasing methods available for PVs that do not extend to energy-efficiency improvements, making consumer investments in PVs more attractive, even if they are not the most cost-effective approach to reducing energy use, energy bills, and maximizing the environmental benefits of reduced energy use.

⁷ Hoen, Wiser, Cappers, Thayer: An Analysis of the Effects of Residential Photovoltaic Energy Systems on Home Sales Prices in California, 2011. LBNL Report 4476E:

⁸ Example PV system cost, using GE cost of \$4/W, installed (CSI report: Detailed Cost Analysis), and a 4.8kW system, as installed on the CSI ZNE home (CSI report: Zero Net Energy Home), a loan would likely be needed to finance the cost of \$19,200.

A. Existing Financing Vehicles and Options

Financing vehicles are readily available for each of the three home improvement situations discussed in the previous section: repairs and replacements, energy-efficiency improvements, and addition of PVs. Energy efficiency, and PV financing vehicles can be divided into three options: 1) Loans, 2) New, innovative financing models, and 3) Rebates incentives, and tax credits. Each of these is discussed below.

1. Loans – Secured and Unsecured

Existing loan options are often based on the traditional mode of self-financing, where a homeowner can borrow money from a financial institution at an agreed upon interest rate and timeline. The loans can be secured or unsecured, depending on whether an asset has been pledged as a collateral by the homeowner. Based on this distinction, loans have been divided into 2 main categories for purposes of this discussion of funding energy-efficiency:

- a. Secured Loans
- b. Unsecured Loans

a. Secured Loans

Generally, a secured loan has better interest rates and better terms and conditions compared to an unsecured loan. This section will address in detail the existing loan options available to the homeowners in California. The section also addresses some innovative secured loan programs that have been recently launched or have been tested as pilot programs.

Secured loans are loans where the borrower pledges some asset as collateral. For example, a residential mortgage loan uses the house being financed as collateral. Secured financing products available for energy upgrades include Energy Efficient Mortgages (EEMs), Energy Improvement Mortgages, Home Equity Lines of Credit (HELOCs), Home Equity Loans (HELs), and HUD Title 1 loans. These different financing products can be differentially spread across three different categories:

- i) SelfFinancing Options:Traditional Loan Models
- ii) Secured Loans Innovation and Recent Pilot Programs
- iii) Municipal and Utility Loans

i) Self Financing Options: Traditional Loan Models

Energy Efficient Mortgages (EEMs)

Energy Efficient Mortgages (EEMs) are enhancements to existing mortgages offered by government sponsored entities, such as Fannie Mae, the Federal Housing Agency, and the Veteran's Administration (VA), that acknowledge and give credit to the energy efficient projects that are incorporated into the mortgage. Such credit can be in many forms, from rates, to loan limits, to borrower qualifications. Recent advertised rates on EEMs ranged from 3 to 4 percent. To get an EEM a borrower typically has to have a home energy rater conduct a home energy rating before financing is approved. This rating verifies for the lender that the home is energy-efficient. EEMs give borrowers the opportunity to finance cost-effective, energy-saving measures as part of a first mortgage and stretch debt-to-income qualifying ratios on loans thereby allowing borrowers to qualify for a larger loan amount and a better, more energy-efficient home. The amount a borrower can borrow on any mortgage is based on factors such as income, outstanding debts, the value of the home, and credit history. The EEM enhanced amount is based on the projected savings in utility costs once the qualified energy efficient projects are installed. These savings must offset any increase in mortgage payments attributable to the enhanced amount. The maximum amounts allowed by lenders may vary for energy efficiency projects.

- Eligible Upgrades: Qualified energy efficiency improvements only
- Interest Rates: Varies by lender, product and term
- Maximum Payment Terms: Up to 30-year fixed or variable rate
- Maximum Financed Amounts: Varies by lender and program
- Who Offers: Banks, mortgage companies, and credit unions (plentiful on the Internet)

The VA EEM is available to qualified military personnel, reservists and veterans for energy improvements when purchasing an existing home. The VA EEM caps energy improvements at \$3,000–\$6,000. Please see Appendix A for *Sample Calculations: EEM Buying Power*.

The Energy Improvement Mortgage (EIM) is another variant on the EEM, where an EEM is generally made as a first mortgage, and intended to help the buyer (or owner refinancing) own the home over time, with the benefits described above, while an EIM is generally a “second” mortgage designed to finance improvements to the home, and not the entire mortgaged amount on the home. The EIM will always include energy-efficiency upgrades, but can also finance other home improvements that upgrade the home.

Third Party Loans

While several home improvement loans originate from government funding through such agencies as HUD and FHA, there also are loans available from “third parties” which provide non-government sourced funding. By utilizing third party funds, parameters such as loan qualifications and eligible measures can be adjusted.

There are several types of third party loans including second mortgages (i.e. secured home equity loans), traditional refinancing loans, and personal loans (i.e. unsecured loans). Third party loans can be secured or unsecured, and are a simple solution for minor improvements or urgent repairs. They typically have an expedient loan process which enables contractors to offer these types of loans during an in-house consultation. Third party lenders may determine if the homeowner is qualified based on information gathered from a phone call, personal visit or through a website. While these factors can sometimes be advantageous for a homeowner in various situations, there are some drawbacks as well (for example, higher interest rates than FHA-backed loans in most cases).

A homeowner should carefully review all other options before considering a third party loan that is not designed with energy improvements in mind, since monthly energy savings will not be factored into the repayment process. Third party loans are frequently used in urgent situations (e.g., equipment failure) where the homeowner does not have the time to pursue other financing options that require verification of the borrowers’ qualifications, or to research other and all loan options. Third party loans recognize this fact and in turn typically carry interest rates that are well above mortgage-market interest rates. Sometimes they can have other unfavorable underwriting criteria. While these 3rd-party loans have a solid place in the equipment replacement market, they are not the preferred vehicle for improving the energy-efficiency of or putting renewable energy devices onto a home.

Home Equity Line of Credit (HELOC)

A second mortgage can be obtained by a homeowner with equity in their property. The lender will also consider the homeowner’s ability to repay the loan (principal and interest) by evaluating their income, debts, and other financial obligations as well as their credit history and expected energy savings. There are several varieties of second mortgages, One is a home equity line of credit (HELOC), these mortgage products allow the homeowner to leverage the equity in their home for use as the homeowner sees fit. A HELOC is intended to be used as needed by the homeowner, and principle is repaid as funds are available to repay. HELOC funds are used for widely-varying purposes from major purchases other than home-related, to furniture to energy efficiency, renewable energy, and/or other home improvements. A HELOC could be used for energy-efficiency improvements, but specialized EIMs and other financing vehicles will generally be available at lower rates.

To minimize their risk, second-mortgage lenders use the property as collateral to potentially recover the debt in the event that the homeowner defaults. While parameters of second mortgages are different, including HELOC, Home Equity Loans, EIMs, etc. and are lender dependent, many lenders set the credit limit on a home equity line by taking a percentage of the home's appraised value (generally 80-percent) and subtracting from that the balance owed on the existing mortgage. See **Error! Reference source not found.**1. for a sample calculation of second-mortgage lending limits. Typically, home equity lines have a fixed time period (e.g. ten years) during which a homeowner can borrow money from the credit line. In addition, a second mortgage comes at a higher interest rate because it carries higher risk than a first. This is because, in the event of default on the entire mortgage owed, they are literally behind the first-mortgage lender to collect on the liquidation of the home, generally at a value well below the appraised value in good condition, leaving the second lender with whatever cash remains from the reduced sale after the first has collected their owed amount (or less).

**Table 1Second-Mortgage Maximum Loan Amounts:
Sample Calculation**

Appraised home value	\$200,000
Lender-specified loan percentage	80%
Percentage of appraised home value	\$160,000
Mortgage balance	\$120,000
Maximum potential loan amount (This is the maximum; the actual lending cap varies based on other factors including credit history, outstanding loans and other debts, etc.)	\$40,000

Home Equity Loans (HELs)

A HEL is a loan that has a fixed rate and term and, like the HELOC, requires qualification of the borrower and uses the home as collateral. Unlike a HELOC, a HEL is typically issued for a specified purpose (although the borrower is not held to that plan), and, as such, is generally issued in one lump sum to the borrower after the loan is approved. The amount that can be borrowed is based home equity (see Table 1, above), on factors such as income, outstanding debts, the value of the home, how much the homeowner owes on their mortgage, and credit history. Home equity loans

and lines of credit are usually, but not always, for shorter terms than first mortgages. A home equity loan can be used as a person's main mortgage in place of a traditional mortgage. However, one can not purchase a home using a home equity loan, one can only use a home equity loan to refinance. In the United States, in most cases it is possible to deduct home equity loan interest on one's personal income taxes.

Traditional Refinancing – “Cash-Out Refinancing”

A traditional refinancing loan is used when a homeowner wants to convert equity in their home into cash that they might use for some other purpose. A typical refinance will result in a new first mortgage, and will require that the homeowner have more equity in the home than loans against the home, and that the borrower has the means to pay off the new loan. Refinancing can be done for many reasons, one of which could be to do home improvements, including energy-efficiency and/or PVs. However, unless the refinance is an EEM, it does not offer any energy improvement incentives and does not recognize the cost savings associated with energy improvements.

There are various types of refinance loans, including those that allow for the homeowner to utilize a percentage of the home's equity to obtain a lump sum loan amount at closing. Similar to a HELOC, there are no restrictions to how the homeowner may use this money. For example, the homeowner could choose to reinvest the money back into the home by using the proceeds to install energy efficiency improvements or install a solar PV system. However these differ from the regular home energy credit loan as they replace the first mortgage, whereas a HELOC is a second mortgage that is separate from the first mortgage. A home appraisal is required for this product. A home energy evaluation is not required to obtain a refinance loan, unless it is also an EEM.

Home Improvement Loans

There are a number of home improvement loans available to consumers interested in ZNE homes. One example is the Title 1 Home Improvement loan. Title 1 is a financing program of the U.S. Department of Housing and Urban Development (HUD). The Title 1 program insures loans to finance small or moderate improvements to a home, such as an energy upgrade. The eligible upgrades include both energy efficiency and solar improvements. The maximum amount that can be financed ranges from \$7,501 to \$25,000, and offered by HUD approved banks and credit unions. The maximum loan term for HUD Title 1 loans is 20 years, and any loan over \$7,500 must be secured by a mortgage or deed of trust on the property.⁹

⁹ http://portal.hud.gov/hudportal/HUD?src=/program_offices/housing/sfh/title/ti_about

Clean Energy Upgrade Financing Program

California homeowners seeking to potentially save on their utility bills and increase the comfort of their homes have a new financing option allowing them to apply for loans with lower interest rates and longer terms than are currently available. The program, called the Clean Energy Upgrade Financing Program, works by providing financial incentives to lenders that encourage them to reduce homeowner interest rates and costs. The program was launched in August 2012 by the California Alternative Energy and Advanced Transportation Financing Authority (CAEATFA), a public agency in the California State Treasurer's Office. The purpose of this program is to reduce the use of energy by making it less expensive for qualified borrowers to finance energy efficiency improvements and renewable energy projects, such as solar panels. The loan terms and interest rates will be determined by each participating financial institution, and rates could be as low as 4.99% with terms up to 15 years and loan amounts as much as \$35,000. About two-thirds of the single family homes in California could benefit from these kinds of improvements.

CAEATFA approves financial institutions to participate, and examples of participating institutions include SAFE Credit Union, Bank of Stockton, Matadors Community Credit Union, and the Sacramento Municipal Utility District (SMUD).

ii) Secured Loans: Innovations and Recent Pilot Programs

There are a number of recent secured loan innovations and pilot programs that represent an alternative to traditional finance programs that can help bridge some of the gaps in the solar PV, energy efficiency and reroofing financing markets. This section discusses four representative programs – the Property Assessed Clean Energy (PACE) financing program, the *PowerSaver* loan pilot, the FHA 203k loan program and the *ENERGYSTAR*® mortgage program. . There are many other innovative programs that have been recently introduced, such as ‘On-Bill Financing’ which also is discussed in the Municipality and Utility Loans section that follows.

Property Assessed Clean Energy (PACE) Program

A Property Assessed Clean Energy (PACE) financing program allows homeowners to apply for low-interest financing for energy efficiency improvements and/or renewable energy systems. The funding comes through a municipal bond that is repaid using an assessment on the home that is repaid over a long term (typically 10 to 20 years) as an add-on to the home’s property tax. The improvement must be permanent and stay with the property so that the payment of the assessment will be transferred to the next homeowner, thereby eliminating the risk of investment loss for the current homeowner.

Over the past decade, several states have adopted legislation that allowed regional municipalities and local governments to delineate a “clean energy district” for selling local bonds and setting up a PACE program. However, currently the PACE financing vehicle is questionable due to the lack of acceptance by housing authorities including the FHA and Freddie Mac and the parent agency, the Federal Housing Finance Agency (FHFA). The main concern regarding PACE financing is that the financed amount is attached to a property as part of the property taxes, and property taxes are the first to be paid should a home be foreclosed. Thus, being attached to the property tax bill, without any force to the contrary, the PACE lien is senior to the first mortgage. In the event of a foreclosure, the balance of the PACE loan will get repaid ahead of the first mortgage. Absent a PACE program, the first lien paid in a foreclosure is the first mortgage. The PACE loans can be sufficiently large that the PACE approach puts the first mortgage lender in jeopardy of not being able to fully recover their investment if the home is foreclosed. For this reason, the FHFA, Fannie Mae, and Freddie Mac (both of which are overseen by FHFA) are opposed to PACE financing and are reviewing policies related to lending on or buying mortgages for properties that participate in PACE financing.

Also, the Office of the Comptroller of the Currency has safety and soundness concerns regarding underwriting criteria for borrowers in PACE jurisdictions. Nonetheless, there remain a number of

well-organized PACE collaboratives in several States intent on increasing the market share of these programs, including Texas.

Table 2 describes the advantages and disadvantages of PACE financing and Figure 2 shows the PACE loan process.

Table 2 Advantages and Disadvantages of PACE

Advantages	Disadvantages
<ul style="list-style-type: none">• Eligibility requirements can be based on regional market (socioeconomics and average equity)• Longer loan term with low monthly bill• Below market interest rates• Improvement measures are attached to the house and can be transferred to new homeowner	<ul style="list-style-type: none">• Lien priority is not structured for traditional home improvement lending• Detailed underwriting criteria required prior to establishing program• Local or state bond districts required for funding PACE programs• May result in forced repayment of any/all outstanding mortgages on property

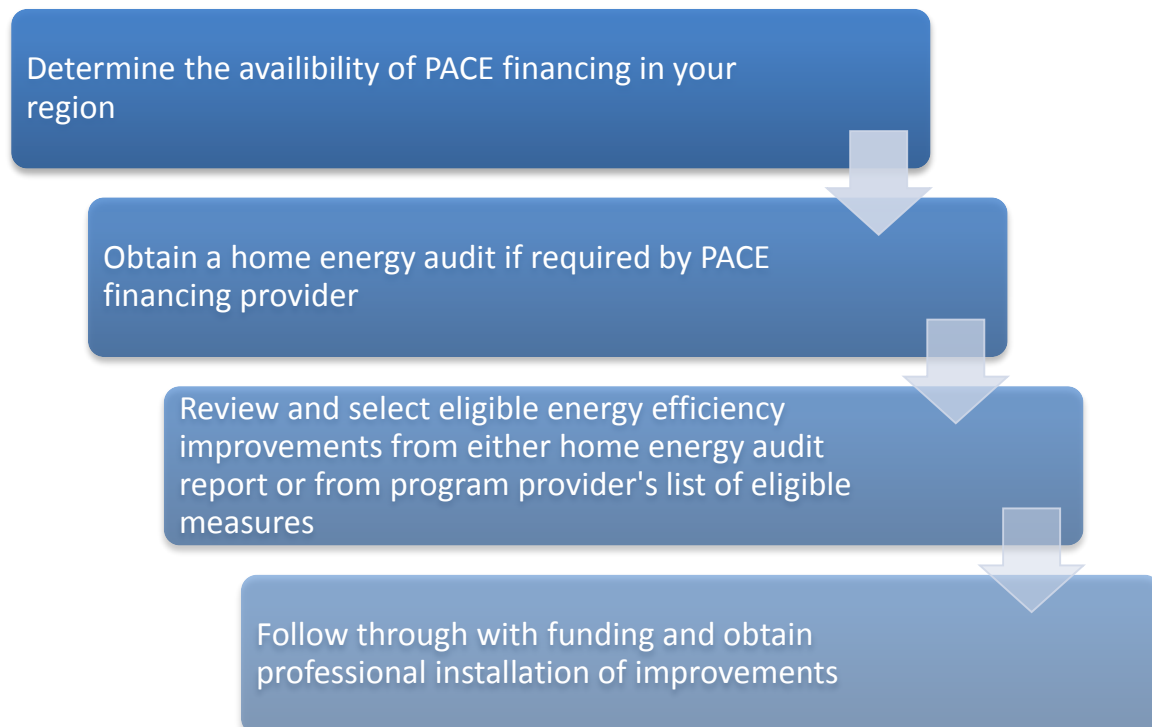


Figure 2. PACE Loan Process

FHA PowerSaver Loan Pilot Program

In response to the *Recovery through Retrofit report*¹⁰, the FHA developed the *PowerSaver* loan, a new energy efficient financing product designed to assist homeowners with financing energy saving improvements to their homes through affordable, federally-insured loans from private lenders. The *PowerSaver* program began as a two-year pilot program in early 2011 in a select number of areas throughout the country. The program offers FHA-insured “low-cost financing to creditworthy borrowers”¹¹ for energy efficiency through lenders who will be selected through an application process.

Homeowners are able to borrow money based on a list of proven, cost-effective measures developed by FHA and DOE. Please see Appendix C for a List of Eligible Measures under the *PowerSaver* Pilot Program. Loan terms are available for as long as 15 years for energy efficiency improvements and 20 years for renewable energy systems. Homeowners are eligible for 100% of the energy efficiency improvement costs, up to \$25,000. Interest rates will be at or below market rate.

Lenders are eligible for grant funding from FHA to further enhance benefits to borrowers, including discount points and interest rate buy-downs. Exterior inspection or other FHA accepted method is used for property valuation. Participants are required to have a minimum 660 FICO score and a 45% DTI ratio (expected energy savings can be used to offset costs). The loan will be disbursed as follows: 50% at time of closing and 50% upon completion of work to the contractor. With *PowerSaver*, although home energy audits will be recommended, they are not required, according to those familiar with this issue. Table 3 shows the advantages and disadvantages of a *PowerSaver* loan and Figure 3 shows the loan process.

Table 3. *PowerSaver* Loan Program Advantages and Disadvantages

Advantages	Disadvantages
<ul style="list-style-type: none">• Simplified home inspection• Longer loan term for lower monthly payback• At or below market interest rates	<ul style="list-style-type: none">• Not a cash out loan; limited selection of eligible improvements• Pilot stage, not nationally available yet

¹⁰ URL: http://www.whitehouse.gov/assets/documents/Recovery_Through_Retrofit_Final_Report.pdf

¹¹ HUD website program announcement:

http://portal.hud.gov/hudportal/HUD?src=/press/press_releases_media_advisories/2010/HUDNo.10-251

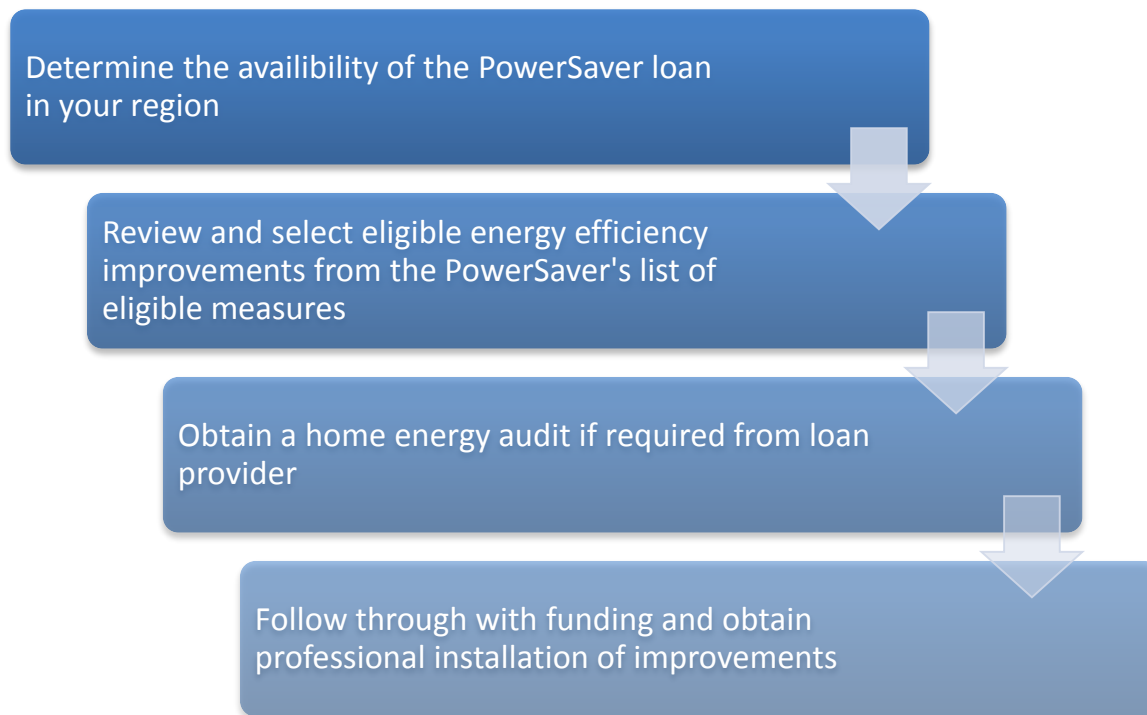


Figure 3. PowerSaver Loan Process

The FHA 203k Loan Program

FHA 203k loans are offered by the Federal Housing Administration. The federal government designed these loans to encourage lenders to fund seemingly risky home purchases. Goals of neighborhood revitalization and greater homeownership opportunities also drove the creation of this loan. FHA 203k loans are designated for houses that are damaged or sorely in need of rehabilitation. The loan covers not only the cost of the property but also the cost of necessary home repairs. The down payment requirement is low, and eligibility criteria are relatively relaxed. Importantly, homeowners can also refinance improvements with these loans. A vast range of repairs, including room additions, bathroom remodeling, roofing, flooring and air conditioning systems can be funded with these loans.

Which houses qualify?

There are two types of FHA 203k loans, regular and streamlined. Regular 203k loans are for homes that need structural repairs, and streamlined loans are for those that need non-structural repairs.

In order to qualify, homeowners must plan to live in the home they are repairing. The following types of residences qualify:

- Tear-downs: As long as part of the foundation will remain, houses that need to be destroyed and rebuilt are eligible
- Existing construction that is at least a year old
- Single-family, two-family, three-family or four-family dwellings
- Condos: if they have been approved for FHA loans.
- Mixed-use properties: If you are repairing only the home portion, a mixed residential/commercial property can qualify.
- Homes needing to be moved to rest on a new foundation.

The FHA has specific guidelines as to which types of repairs qualify for 203k loans. The lender will also stipulate which repairs the owner can make. Allowable repairs include disability access, heating, ventilation and air conditioning, plumbing, roofing and flooring, energy conservation, kitchen remodeling, new appliances, room additions, decks and patios, bathroom remodeling, room additions or second-story additions, new siding, finishing an attic or basement and site grading. Please see Appendix B for an FHA Traditional 203(k) and Streamline 203(k) Loan Eligible Improvements List.

Labor costs must be included in the loan, even if the homeowner performs the repairs. The repairs must be completed within six months.

The FHA 203k loan amount has to include the price of the home *plus* the expected price of repairs. The maximum amount of money a lender will loan under an FHA 203k depends on the type of loan (regular vs. streamlined). With a regular FHA 203k, the maximum amount loaned is the lesser of these two amounts: 1) the as-is value of the property plus repair costs, or 2) 110-percent of the estimated value of the property once you do the repairs. With a streamlined loan, you can get a loan for the purchase price of the home plus up to \$35,000. To determine the as-is value of the property or the estimated value of the property post-repair, an appraisal is often required. The homeowner is required to put down 3.5 percent, and the money can come from a family member, employer or charitable organization.¹² That percentage is usually far below that required by conventional loans and other FHA loans.

In order to apply, the loan applicant has to provide proof of income, proof of assets and credit reports. In addition, the applicant has to provide a home appraisal, including how much the home will be worth after the improvements are made. The applicant also has to present a detailed proposal of the work required on the home, including a cost estimate of each repair. Some loan seekers hire a 203k consultant to prepare the extra paperwork. The consultant's fees can be included in the loan amount.

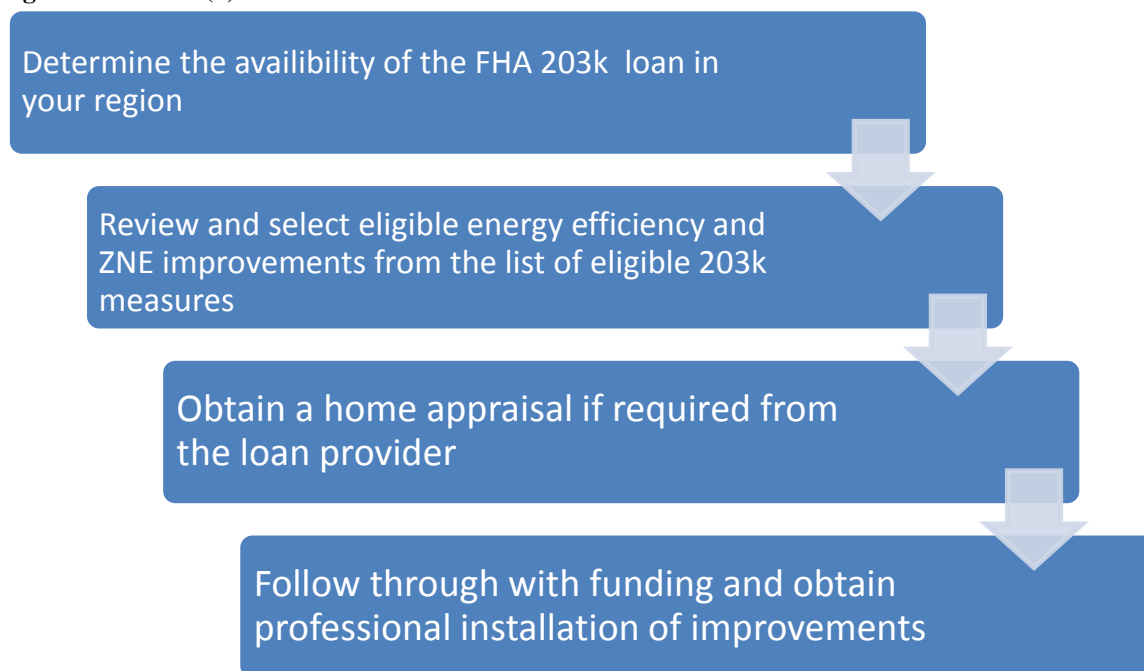
¹² <http://www.zillow.com/mortgage-rates/finding-the-right-loan/fha-203k/>

An FHA 203k loan is especially beneficial to those who cannot afford a finished home and are willing to take on a fixer-upper. Many lenders do not offer 203k loans, and document preparation and bureaucracy is said to be especially time-consuming. A FHA 203k closing can take from 60 to 90 days. Interest rates tend to be high, due to the risk involved to the lender. The home improvements cannot guarantee to increase the value of the home.

Table 4 FHA 203(k) Loan Program Advantages and Disadvantages

Advantages	Disadvantages
<ul style="list-style-type: none"> • Government-backed loan • Loan value can include both the home and improvements • Longer loan term for lower monthly payback amount • Required down payment is low, and can come from outside sources 	<ul style="list-style-type: none"> • Application process is said to be relatively long • Repairs need to be completed in short time span • Relatively low cap on loan amount available for improvements • No history of solar PV loans through this vehicle

Figure 4 FHA 203(k) Loan Process



ENERGY STAR® Mortgage Pilot Program

In Maine and Colorado, the *ENERGY STAR®* Mortgage Pilot Program is available for existing homes that undergo a *Home Performance with ENERGY STAR®* assessment and improvement process that yields a minimum 20% energy savings; it is also available to new homes that are built under the *ENERGY STAR®* Homes Program. An *ENERGY STAR®* mortgage offers a minimum 2% stretch on a borrower's DTI ratio, plus an additional incentive for borrowers: an *ENERGY STAR®* mortgage requires that lenders provide a verifiable borrower benefit as a part of the mortgage loan that is over and above the energy savings advantage to the homeowner, such as discounting of mortgage rates, closing cost assistance or other benefits to induce consumer interest. The program is a joint program of the Environmental Protection Agency and the U.S. Department of Energy and work is underway to bring it to a number of other states in the near future. Table 4 displays the advantages and disadvantages of the *ENERGY STAR®* mortgage and Figure 4 shows the loan process.

Table 5. *ENERGY STAR* Mortgage Advantages and Disadvantages

Advantages	Disadvantages
<ul style="list-style-type: none">• <i>ENERGY STAR</i> label provides confidence in energy improvements for homeowners and public• Standard EEM benefits plus an additional incentive	<ul style="list-style-type: none">• Pilot stage, not nationally available yet

Figure 5 Energy Star Mortgage Process



iii) Municipalities and Utility Loan Programs

Municipalities (including local governments) and utility service providers have long recognized homeowners' lack of access to capital as a significant and ubiquitous barrier to deploying energy efficiency and solar PV. Municipality and utility financing is available to some residential (and commercial) customers and can be administered at the utility, state, or local/municipal level (Warren 2011). Utility financing programs are typically structured to be cash-flow neutral or positive so that electricity savings are equal to or greater than the cost of the loan. Utility financing programs can be funded by utilities with ratepayer, shareholder, or borrowed funds (Brown 2009).

Some of the challenges to utility financing include being limited to the participating utilities' service territory, the short-term nature of some programs, and the risk of the actual electricity savings not being able to offset the financing costs.

Utility loans come in two primary forms: (1) "on-bill financing" (which is actually on-bill loan payment) where the customer repays the principal and interest via their electric bill (or on a separate bill accompanying the electric bill) and (2) metered-secured financing, in which the loan is tied to the meter/property. Because an on-bill loan is tied to the borrower, the homeowner must repay the loan before they move. In contrast, a meter-secured loan is underwritten to the property (DOE 2011b). Thus, if the property is sold, the buyer could potentially take over the loan payments.

Community energy loan programs can be structured to integrate the various variables involved in a home retrofit and combined with solar PV installation and reroofing. The programs deployed at a community scale can enjoy significant economies of scale that reduce costs and make a larger impact on energy savings. Furthermore, community financing programs can reduce transaction costs, contribute to workforce development and training, and raise customer awareness and access to information about energy efficiency.

The following section discusses existing energy efficiency financing programs that have been designed and implemented by municipalities or utility providers. While such programs are not available in all communities or regions, homeowners should be aware of these types of programs and review any locally available programs.

On-Bill Financing Programs

On-bill financing programs (or "on-bill repayment") utilize the existing relationship between the homeowner and the utility service provider to simplify the process of lending and repayment of energy efficiency improvement financing.

Under this program, homeowners receive financing for energy efficiency improvements from their utility service provider based on their utility bill payment history. They repay the loan as an additional line item on their monthly utility bill. There are little to no upfront capital costs required of the homeowner. Typically, the monthly charge must be less than the expected savings from the efficiency improvements and the loan term must be less than the expected life of the energy efficiency improvements.

On-bill repayment allows for a streamlined process as utilities already have access to information about the homeowner's energy usage patterns and payment history. An on-bill repayment program is useful in illustrating the impact of energy efficient improvement since the energy cost savings are on the same bill as the loan repayment. There are two types of on-bill repayment programs including on-bill loans and on-bill tariffs.

a) On-Bill Loans

On-bill loans are similar to most other home improvement loans in that if the homeowner moves they must repay the full loan. From the utility perspective, on-bill loans do not require state regulatory approval and the utility can set the financing terms, while tariff-based loans require regulatory approval for the program and terms. An on-bill loan program lends itself well to improvements with shorter financing periods.

b) On-Bill Tariffs

Unlike the on-bill loan, an on-bill tariff is attached to the meter so that when a homeowner moves, the next homeowner at that meter continues to repay the financing. On-bill tariffs are significantly more complicated to set up, but they allow a longer financing term.

Table 6. On-Bill Financing Advantages and Disadvantages

Advantages	Disadvantages
<ul style="list-style-type: none"> • Simple repayment method • Longer loan term • Relatively simple eligibility analysis based on historical customer relationship 	<ul style="list-style-type: none"> • May complicate sale of property • Default can result in utility disconnection • Complex structure for on-bill tariff • Potential to not be cost effective if loan is repaid prior to receiving full energy savings

Revolving Loan

Revolving loans utilize public funds from state bond proceeds, treasury investments, ratepayer funds, and other special funds such as ARRA (American Recovery and Reinvestment Act, commonly referred to as the “Stimulus Act”) funds for distribution to homeowner in the form of home improvement and/or energy efficiency loans. The loan repayment funds are reinvested into the public funds for distribution to subsequent homeowners applying to the loan fund. Revolving loans are available from third parties, including traditional lenders and also from government entities such as state and local municipalities.

A revolving loan typically focuses on financing the cost of energy efficiency upgrades such as appliances, lighting, insulation, and heating and cooling system upgrades. These loans are made to homeowners consistent with standard prudent lending practices. However, they are more favorable to local residents in that they are structured to service the regional market needs based on such factors as socioeconomics, local equity levels, and overall program goals.

Typical eligible improvement costs are about \$2,000 to \$10,000; a successful revolving loan program is limited to measures that are too expensive for a homeowner to purchase upfront but do not warrant taking out a second mortgage or equity line. The loans are provided to the homeowner with the intent to improve the energy efficiency of the home and thereby improve the financial stability of the household, reducing the risk of loan default, thereby increasing community stability. The majority of loan terms are under ten years. Revolving loan programs are limited by their ability to attract borrowers based upon numerous factors including interest rates, loan term, credit requirements, and marketing effectiveness. Table 6 describes the advantages and disadvantages of revolving loan programs.

Table 7. Revolving Loan Program advantages and disadvantages

Advantages	Disadvantages
<ul style="list-style-type: none">• Eligibility requirements can be based only on the local or regional market (such as socioeconomics and average equity)• Long term availability of funds• Below market interest rates	<ul style="list-style-type: none">• Potential risk of high default if not structured appropriately• Detailed underwriting criteria required prior to establishing program• Dependent on capital availability

b. Unsecured Loans

Unsecured loans are not backed by any collateral, and are therefore usually made available with more stringent terms and conditions. Credit markets are tight currently, but lines of credit are still available from lenders, usually at higher interest rates than first mortgage products, especially for unsecured lines of credit. Available unsecured loans include personal loans and loans through construction contractors.

For property owners willing to pay higher interest rates for financing, unsecured loans are available through groups such as the Electric and Gas Industries Association (EGIA). This financing vehicle can also be provided by qualified home performance contractors who may package the loan with contracted home energy upgrades to keep the process simple and enable the homeowner to make the decision to do the retrofits and gain improved comfort and lower utility bills. The unsecured loans can thus be divided into the following sub-categories:

i. Personal loans

- ii. Home Improvement Loans - HUD Title 1 Loans
- iii. Contractor Sponsored Loans

i) *Personal loans*

a. *Unsecured Personal Loans (General Line of Credit)*

A personal loan is solely based on creditworthiness (typically determined by the homeowner's FICO credit score and/or credit history) and does not require borrowers to have a home or borrow against either value or equity of a home. The interest rates are traditionally higher than market value but can provide a better alternative to credit cards that have even higher interest rates.

b. *Unsecured Home Improvement Loans*

An unsecured home improvement loan is designed for homeowners with good credit who are interested in financing home repairs and/or improvements, including energy efficiency measures, without tapping into the equity of their home.

Unsecured home improvement loans do not require any collateral but typically must be used for home improvement projects. By definition, all improvements that increase the value of the property in such a way that it increases the expected sale value of the home are to be considered home improvements. Currently, there are no national standards for the appraisal of home energy efficiency improvements, thus it is possible that a home improvement loan may not recognize the energy efficiency improvements as eligible measures. Homeowners should always review the eligible improvements allowed by a lender before obtaining financing.

Typically, home improvement loans require a minimum loan amount of \$5,000. Many lenders offer same day approval. Contractors are quick to offer these loans because they provide a rapid credit

approval process, which assists them in obtaining a signed contract on the same day of the home visit.

ii) HUD Title 1 Home Improvement Loans

Unsecured loans are available as well through the HUD Title1 Home Improvement Loan program of the U.S. Department of Housing and Urban Development (HUD). The Title 1 program insures loans to finance small or moderate improvements to a home, such as an energy efficiency upgrades and solar PV installations. The loans are offered by HUD approved financial institutions. The unsecured HUD loans are limited by a maximum amount of \$ 7,500 that can be borrowed.

iii) Contractor Sponsored Loans - EGIA GEOSmart

Home owners can get unsecured loans for specific improvements through qualified building contractors. While most unsecured home improvement loans are not targeted at reroofing, solar PV or energy efficiency measures, there are currently a few programs that do recognize the benefits of cost-effective, energy efficient measures.

One such example is the Electricity & Gas Industries Association's (EGIA) GEOSmart unsecured residential financing program. The GEOSmart program offers loan amounts of up to \$25,000 for energy efficiency improvements and renewable energy systems. EGIA stays competitive with other energy efficiency improvement loans by leveraging utility energy funds to buy down the interest rate to at or below market rates.

2. Innovative Financing Models - Third Party Ownership (PPA and Lease) and ESCO model

As mentioned at the beginning of this report there have been a number of innovations in financing solar PV and energy efficiency that have resulted in an exponential growth in the deployment of solar PV in the residential sector and the deployment of energy efficiency in the commercial buildings sector. California based companies such as *SolarCity* and *SunRun* have been at the forefront of this innovation.

This section will discuss these innovative models that include:

- i. Power Purchase Agreements (PPA) for Solar PV
- ii. A Leasing Model for Solar PV
- iii. The ESCO (Energy Service Company) Model for energy efficiency

These three models have been focused on tackling the most fundamental and the most important barrier to the large scale adoption of solar PV systems and energy efficiency – large upfront costs and long payback periods. These new financing models have become prominent over the last several years (see figure 5 – 3rd party ownership (TPO) over the last 6 ½ years), simultaneous with a large drop in the installed costs of PVs. PV systems cost reductions have been due to large decreases in module costs, international competition, some decreases in balance of system costs and installation costs. At least one major marketer of PV systems has used the 3rd party ownership leasing model very creatively, with investors providing the capital to acquire, market and install the systems, in return for which the investors receive solar tax credits, rebates & incentives, and depreciation tax credits for the systems. The combination of reduced systems costs and innovative financing and business practices has allowed them to become the number one residential PV systems provider in the US. Their primary market has been selling to production builders in the new-construction market, and they have recently sold systems in that market segment for under \$1/Watt, installed. The total lease cost is paid up-front by the builder or the buyer for a no-additional cost, 20 year lease (less than \$4,800 for a 4.8kW system, for example). A sometimes overlooked, potential downstream cost of a TPO PV system, particularly in retrofit applications, is a future need for a re-roof, within the life of the PV system and during its contracted lease and/or PPA period. There is typically a clause in the contract that any costs incurred for re-roofing is the responsibility of the homeowner. Therefore, the condition of the building's roof, at time of PV installation is critically important to the TPO model being cost-effective. Existing home owners would be well advised to perform a careful analysis of structural integrity, condition of and remaining life of the roofing material, the PV installer's warranty and responsibilities in the situation that leaks occur post installation, as well as the impact of the PV installation on any existing roofing warranties. Roof repair in the middle of 10-year PV PPA can be problematic and totally change any cost-effectiveness calculations that did not consider the condition of the roof at

installation. Fortunately the major companies marketing TPO. Typically, the provider will perform an inspection of the roof to determine the condition. Some roofs may need to be replaced prior to installation of solar panels. Projects may also require an engineering certification on roof loadings and roof warranty. In some cases, a company offering TPO systems may include roof improvements or replacement.

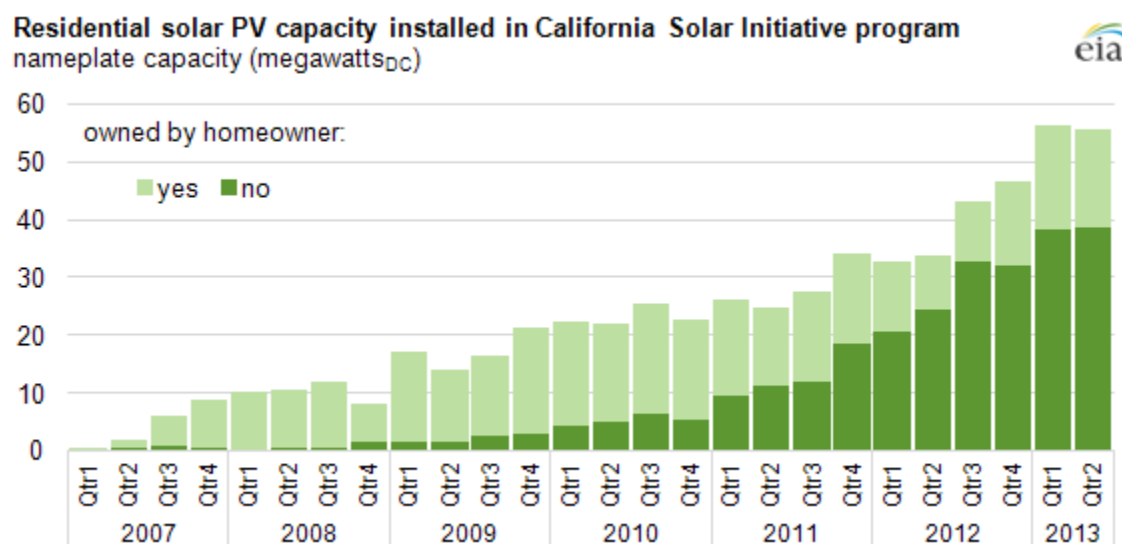
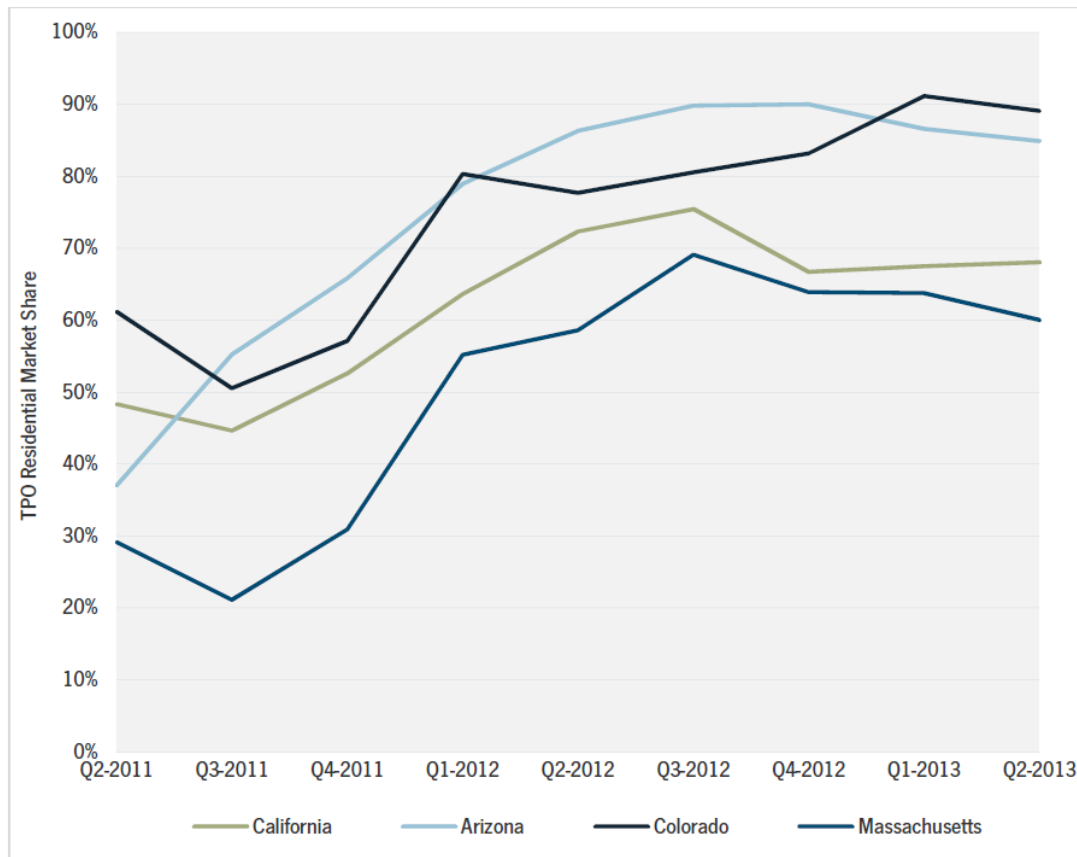


Figure 6 Third Party Ownership in CA

While PPAs and leasing models have not been adopted to energy-efficiency, there are no fundamental reasons why they could not be so adapted. These will be discussed in the appropriate sections below.

Third party ownership arrangements have dominated solar PV markets recently in many States. As shown in Figure 6 an average of roughly 75-percent of PV sales in the second quarter of 2013 were arranged through third party ownership in the States of California, Arizona, Colorado and Massachusetts. Notably, almost 95-percent of sales in Colorado were through third party lessors in this quarter.



Source: SEIA/GTM Research: U.S. Solar Market Insight® (Q2 2013)

Figure 7 Third Party Ownership in Several States.

a. Power Purchase Agreement (PPA)

A Power Purchase Agreement (PPA) is a financial arrangement in which a renewable energy system provider installs, owns, operates, and maintains the system while the home owner agrees to allow the system to be installed on their property and purchase the electricity generated by the system from the provider for a predetermined period at a preset rate or rate-schedule where the rate changes, typically increasing, over time.

The monthly PPA bill to the homeowner varies based on the actual power produced by the PV system. The third party is responsible for the operations and maintenance of the PV system, and related maintenance costs. They are typically explicitly excluded from having any responsibility for the roof, as discussed in the introduction to this section.

Benefits from PPAs include stable, predictable, and often lower cost electricity provided to the building owners, offsetting the electricity that they would otherwise purchase from the electric utility, with little to no upfront capital costs. Typically, the electricity cost rate for a PPA is set to match or be slightly below the local utility provider's market electricity cost rate. While the local utility provider's electricity cost rate increases over time, the building owner is locked in to the preset electricity cost rates scheduled under the PPA, which are intended to be lower than the rates from the electric utility. Given that the PPA rate schedule, which typically does include rate increases over the life of the PPA, does not have more aggressive rate increases than the electric utility, the PPA will provide both known and predictable energy costs over the life of the agreement, as well as significant cost savings over the contracted period. Also, the building owner can gain some personal or even marketing benefit from the fact that clean energy is being generated from the PV system on their property.

The PPA provider receives the eligible tax credits for the renewable energy system, as well as the income from the PPA electricity bill paid by the building owners and the net-metered energy paid by the local utility provider, should there be any surplus energy generation. The system provider uses modeling software to determine the optimal system size for the homeowner's and PPA provider's best returns on investment. At the end of the PPA term, the building owner can select one of three options: 1) renew the lease term for an extended period of time; 2) purchase the system; or 3) have the system removed.

PPA drawbacks include complex contracts and the risk to the provider associated with doing a PPA on a small scale. However, as utility costs increase and generation system costs decrease, PPAs are likely to increase in popularity as more homeowners perform energy efficiency retrofits.

Table 7 describes the advantages and disadvantages of a PPA.

Table 8. Power Purchase Agreement Advantages and Disadvantages

Advantages	Disadvantages
<ul style="list-style-type: none"> • Little to no upfront capital costs to the building owner • Reduced dependence on utility providers • Stable, lower annual electricity cost • Little to no maintenance and operations costs for the building owner • Instant return on investment 	<ul style="list-style-type: none"> • Requires optimal location for energy production from solar or wind harvesting • Small-scale investment for provider results in high fixed costs and less return • Complex agreement that requires significant amount of time for processing and installation • Good roof condition is required; may require replacement or repair prior to PV systems installation • Currently only available in locations with high utility rates, tax incentives, and/or state incentives for renewable generation

b. Leases: Solar PV Leases

A Solar Lease is a financial arrangement in which a third-party developer installs and owns a photovoltaic (PV) system on the home, and the TPO leases the PV system to the homeowner. The homeowner is required to pay a pre-determined lease payment for the system on the roof. The electricity generated by the PV system belongs to the homeowner and the home is net-metered, so the homeowner pays the electric company for any net-electricity use, based on the net metering tariff used by the electric company. When used to install systems on a new home, the TPO leasing company will require that the entire 20-year lease cost be paid in full, up-front.

The lease agreements differ from the PPAs on mainly two accounts. One, the lease payment is a fixed monthly amount, or one-time payment, that needs to be paid to the TPO, as in the case of any other leased asset (e.g. a leased car), compared to the variable amount paid through the PPA agreement based on the actual electricity generated, and possibly a rate schedule that increases over time.

Second, unlike the PPA the lease agreement may or may not cover the any maintenance costs under the lease. Solar leases are attractive homeowners because of the relative simplicity of the lease when compared to a PPA. Operating and maintenance costs may pose a risk to the homeowner,

depending upon the terms of the lease, and generally these risks are mitigated by long-term warranties.

c. Energy Performance Contracting through ESCO

Energy Performance Contracting (EPC) is a turnkey solution for building owners (typically of commercial buildings and not residences) who are looking to add major energy improvements to their building with little to no financial risks, upfront cost or maintenance requirements. Under an EPC program, an Energy Service Company (ESCO) works with a building owner through the entire retrofit process starting with an energy audit, and will prescribe a comprehensive set of energy improvement recommendations based on the audit findings. The audit findings not only recommend the improvements, but also predict the energy savings resulting from the improvements. EPC programs generally focus on the commercial and industrial sectors.

Energy consumption in commercial and industrial buildings can be modeled and predicted more precisely than residences because the non-residential buildings typically have known and regular hours of occupation and consistent energy usage patterns, from year to year.. The consistencies in energy use throughout the year and over a period of years can often be attributed to building functions being highly automated and scheduled, such as lighting and HVAC controls, through a sophisticated energy management system, either pre-existing or installed by the ESCO as part of the retrofit. Due to the predictability of energy use in these types of buildings, the expected utility bill savings rendered through energy efficiency retrofits can also be predicted quite accurately. While the following two financing options are primarily available for commercial or industrial building retrofits, they have the potential to be successful in the residential sector as well.

An ESCO is typically a commercial business providing a broad range of comprehensive energy solutions, including design and implementation of energy savings projects, energy conservation, energy infrastructure outsourcing, power generation and energy supply, and risk management. Once an appropriate set of improvements is agreed upon by the building owner, the ESCO will coordinate installation, arrange financing (directly or indirectly through the ESCO) and begin monitoring the energy consumption of the upgraded systems. The monitoring is often done through the energy management system so that the building operator can identify variances and work to avoid those that increase energy use. This is a key element in the success of an ESCO providing EPC. The element of defining a building operations schedule, implementing it in a good home energy monitoring system, and recording and compensating for variances is typically lacking and/or unenforceable in residential retrofits.

The EPC program allows only for energy improvements where the savings produced by the improvements are sufficient to repay the capital cost of the measures over the term of the contract,

which is typically 10 to 15 years. Typically, the ESCO provides a guaranteed level of energy savings and thereby has a financial stake in the performance of the energy improvements; subsequently the ESCOs are closely involved in the entire process. Note that energy savings guarantees will usually be adjusted based on factors that the ESCO cannot control, such as changes in weather, building occupancy, and energy prices. If the project produces less than the guaranteed savings, the ESCO will pay the building owner the difference. Furthermore, most ESCOs offer lifetime maintenance of the energy improvements. Table 8 describes the advantages and disadvantages of Energy Performance Contracting.

Table 9. Energy Performance Contracting Advantages and Disadvantages

	Disadvantages
<ul style="list-style-type: none"> • Turnkey simplicity for energy improvements • Energy savings are monitored and guaranteed • Building owner is not responsible for maintenance or associated costs • Does not require loan transference to new building owner or repayment 	<ul style="list-style-type: none"> • Not appropriate for minor improvements • Complex program structure, designed for long term return on investment • Not all improvements can easily be removed if new homeowner is unwilling to take on the contract loan

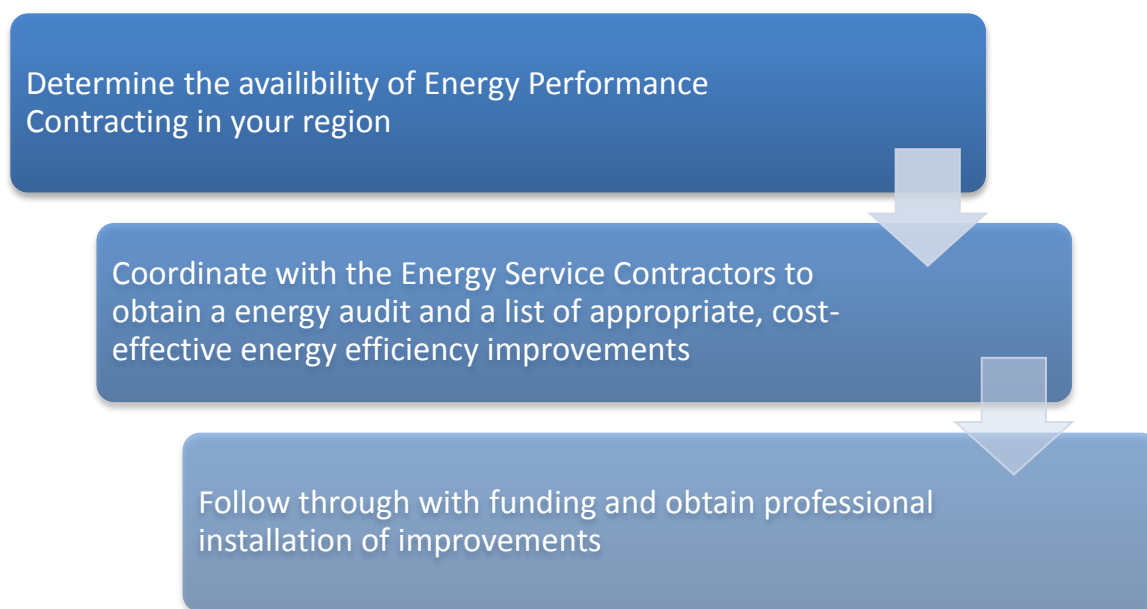


Figure 8. Energy Performance Contracting Loan Process

Again, the most appropriate financing option will depend upon many factors such as the amount needed, debt capacity and risk tolerance. For the homeowner with equity and/or good credit, there are viable options for energy efficiency retrofit projects from small weatherization improvements to large retrofits including new HVAC equipment, windows, and even energy generation, such as photovoltaic panels (PVs). To assist readers in understanding and comparing the various parameters of the financing product options we provide summaries provide summaries of energy efficiency financing options and the associated lending criteria, terms and typical purpose of each loan type below in Table 10.

Table 10. Energy Efficiency Financing Considerations and Trade-offs

Financing Considerations ¹³	Financing Product	Trade-off ¹⁴
Minimum equipment maintenance	<ul style="list-style-type: none"> Power Purchase Agreement 	<ul style="list-style-type: none"> Ownership issues and lease-end payments Significant paperwork & processing time for homeowner

¹³ Defined as energy efficiency and solar PV financing conditions and/or energy efficiency retrofit outcome expectations.

¹⁴ Also referred to as loan limitations.

Financing Considerations ¹³	Financing Product	Trade-off ¹⁴
	<ul style="list-style-type: none"> Energy Service Contracting 	<ul style="list-style-type: none"> Ownership issues and lease-end payments Significant paperwork & processing time for homeowner
Major home improvements	<ul style="list-style-type: none"> “Cash-out” Refinance Loan 	<ul style="list-style-type: none"> Standard debt to income ratio Does not recognize cost savings from energy efficiency improvements
	<ul style="list-style-type: none"> Streamlined 203(k) 	<ul style="list-style-type: none"> Limited eligible measures
	<ul style="list-style-type: none"> Title I Loan 	<ul style="list-style-type: none"> Must be completed within 90 days of closing
	<ul style="list-style-type: none"> Unsecured Personal Loan 	<ul style="list-style-type: none"> Above market interest rate; shorter term Standard debt to income ratio Does not recognize cost savings from energy efficiency improvements
Little to no equity	<ul style="list-style-type: none"> Third Party Loan 	<ul style="list-style-type: none"> Above market interest rate; shorter term Standard debt to income ratio Does not recognize cost savings from energy efficiency improvements

Financing Considerations ¹³	Financing Product	Trade-off ¹⁴
	<ul style="list-style-type: none"> Unsecured Personal Loan 	<ul style="list-style-type: none"> Above market interest rate; shorter term Standard debt to income ratio Does not recognize cost savings from energy efficiency improvements
Loan attached to property	<ul style="list-style-type: none"> On-Bill Tariff 	<ul style="list-style-type: none"> Risks associated with home resale
	<ul style="list-style-type: none"> PACE 	<ul style="list-style-type: none"> Risks associated with home resale
Loan amount: up to \$25,000	<ul style="list-style-type: none"> 203(k) Streamlined 203(k) 	<ul style="list-style-type: none"> Limited eligible measures
	<ul style="list-style-type: none"> Title I 	<ul style="list-style-type: none"> Must be completed within 90 days of closing
	<ul style="list-style-type: none"> FHA PowerSaver 	<ul style="list-style-type: none"> Pilot program, not nationally available
	<ul style="list-style-type: none"> Conventional EEM 	<ul style="list-style-type: none"> Not appropriate for urgent home improvements Significant paperwork & processing time

3. Rebates and Incentives

There are numerous rebates and incentives offered to a homeowner for upgrading to energy efficiency equipment, upgrades and for installing solar PV and solar hot water systems. A comprehensive and updated list can be found on the Database of State Incentives for Renewable Energy (DSIRE)¹⁵ website. The incentives vary based on city, county and state, associated utility and the nature of the upgrade or equipment. Some of the important and significant rebates and incentives include:

a. Federal Tax Incentive for Solar

A Federal Investment Tax Credit (ITC) was established for the residential sector, by the Energy Policy Act of 2005. The residential ITC will remain at 30% until the law expires in 2017. The law could be reinstated in 2017. The ITC reduces the taxes owed to the Government by 30% (up to an amount of \$2,000) to the owner of solar PV system installed on a residence.

b. Energy Upgrade California - All Electric Homes - Existing Home

Energy Upgrade California is a relatively new incentive program for California utility customers, including all-electric homes. Incentives of up to \$4,000 are available to utility customers who participate in the Advanced Package of energy-saving home improvements. Energy Upgrade California offers Whole Home rebates to reward customers for addressing their home energy efficiency needs as a system instead of piece-by-piece. The amount available varies based on the city and the associated utility company.

The rebate amount depends on the homeowner's location and the specific project but may include:

- Up to \$4,000 in utility incentives
- Local city and county rebates

The Energy Upgrade California program serves as a one-stop shop for California homeowners who want to improve the energy efficiency of their homes. The program connects homeowners with qualified contractors, and helps homeowners find all of the available incentives from their local utilities and local governments. Interested California homeowners can go to the website (<https://energyupgradeca.org/overview>) and select an eligible contractor to get started. There are two Energy Upgrade packages a homeowner can choose from: the Basic Upgrade Package, and the

¹⁵ DSIRE – Database of State Incentives for Renewable Energy; <http://www.dsire.org>

Advanced Upgrade Package.

Basic Upgrade Package

The Basic Upgrade Package offers up to \$1,000 for certain energy improvements. A participating contractor will implement these standard improvements as needed and apply for the \$1,000 rebate on behalf of the homeowner:

Advanced Upgrade Package

The Advanced Upgrade Package offers greater incentives for a wider variety of energy improvements. The program begins with a home energy assessment which will identify and prioritize potential energy savings for the home. The homeowner can then select a participating contractor to make the improvements. A rebate between \$1,500 and \$4,000 will be awarded to the homeowner based on the predicted energy savings, with a minimum required savings of 15%.

c. California Solar Initiative (CSI) Rebates and Incentives

The California Solar Initiative program provides more than \$2 billion worth of incentives to customers for installing solar PV and electricity displacing solar thermal systems in the three California Investor-Owned Utilities service territories. The goal of CSI is to install approximately 1,940 MW of new solar generation capacity from 2007 to 2016.

CSI Energy Efficiency Incentives

The California Public Utilities Commission (CPUC) voted in October 2011 to create the California Solar Initiative (CSI) Thermal Low-Income program for single and multifamily residential properties. The program offers rebates that are substantially higher than provided under the CSI-Thermal General Market Program.

The program is only available to customers who currently heat their water with natural gas in the service territories of Pacific Gas and Electric Company (PG&E), San Diego Gas & Electric (SDG&E), and Southern California Gas Company (SoCalGas). For single-family residences, customers must be participating or have previously participated in an Energy Savings Assistance Program (ESAP), and the property must remain low-income for at least 10 years. For multifamily housing property, at least 50% of all units in the structure must be occupied by ratepayers who have participated in an ESAP. The residences must also meet the definition of low-income residential housing in California Public Utilities Code 2861(e). Additional requirements are outlined in the CSI Thermal Handbook.

Incentives will be determined based on the expected performance of the system as using the SRCC rating and the specific orientation of the system. Incentives will step down over time in four steps

as program participation levels are met. See the website above and the CSI Thermal Handbook for more information.

CSI PV Incentives

The CSI provides financial incentives for installing solar technologies through a variety of smaller sub-programs. Of the total funding for the CSI, \$216 million has been set aside for programs to help fund PV installations on low-income housing. Half of that \$216 million is funding the Multi-Family Affordable Solar Housing (MASH) program, and the other half is funding the Single-Family Affordable Solar Housing (SASH) Program. The SASH program is being administered on behalf of the investor-owned utilities by GRID Alternatives. Income-eligible customers of Pacific Gas and Electric (PG&E), Southern California Edison (SCE) and San Diego Gas and Electric (SDG&E) may participate. In general, the household's total income must be 80% of the area median income (AMI) or less.

Twenty percent of the total funds for the SASH program (\$21,668,000) will be dedicated to providing fully subsidized 1 - 1.2 kW systems to qualifying households. Qualifying households are owner-occupied and the total income for the household is up to 50% of AMI. Households making more than 50% of AMI, but less than 80% of AMI can be eligible for a partially subsidized system.

Before a PV system is installed through the SASH program, all appropriate energy efficiency measures should be pursued. If an applicant's income status qualifies for the Low Income Energy Efficiency (LIEE¹⁶) program, GRID Alternatives' staff will assist the applicant in enrolling in the LIEE program. If a client does not qualify for the LIEE service, GRID Alternatives' staff will conduct a basic residential energy audit.

The following table summarizes the various loan and financing options available for energy efficiency financing:

Table 11. Energy Efficiency Financing Product Summaries

¹⁶URL: CPUC website - <http://www.cpuc.ca.gov/PUC/energy/Low+Income/liee.htm>

	Eligible Measures	Loan Limitations	Equity Req.	Down Payment Req.	Inspection Req.	Interest Rate	Term	Funding Source
FHA EEM¹⁷	Energy improvements & renewables (from HERS report)	\$4,000 or 5% of the property value (up to \$8,000) maximum	Lender dependent	No	HERS report	Below-market interest rate ¹⁸	Up to 30 years	Lender ¹⁹
Conventional EEM	Energy improvements & renewables (from HERS report)	Up to 15% of the home's appraised value	Lender dependent	No	HERS report	Market interest rate	Up to 30 years	Lender
203(k)	Energy improvement, solar water heaters, & major home improvements	Minimum: \$5,000 Maximum: Determined from 203(k) loan amount worksheet (up to 35% of property value)	Lender dependent	Cost of EE measures are included in down payment calculation (see Appendix E)	Home inspections by HUD-approved consultant	Lender dependent/market rate	Lender dependent	Lender

¹⁷ Energy Efficient Mortgage

¹⁸ Market interest rate refers to the typical rate for a first mortgage at the time of the loan under consideration is completed.

¹⁹ Defined as a bank or residential financing institution

	Eligible Measures	Loan Limitations	Equity Req.	Down Payment Req.	Inspection Req.	Interest Rate	Term	Funding Source
Streamlined 203(k)	Energy improvements & non-structural home improvements	Up to \$35,000	Lender dependent	Cost of EE measures are included in down payment calculation	Home inspections by HUD-approved consultant if loan is greater than \$15,000	Lender dependent/ market rate	Lender dependent	Lender
Title I	Energy & home improvements & renewables	Up to \$25,000	No	No	No, if loan is less than \$7,500	Market rate	Up to 20 years	Lender
PPA	Renewables	Program dependent	No	No	No	Program dependent	10 to 20 years (provider dependent)	Power purchase provider
Secured Home Loan	Energy & home improvements, & renewables	Program dependent	Program dependent	Program dependent	Program dependent	Market rate	Typically up to 30 years (program dependent)	Lender

	Eligible Measures	Loan Limitations	Equity Req.	Down Payment Req.	Inspection Req.	Interest Rate	Term	Funding Source
HELOC²⁰	No restrictions	Lender dependent (less than or equal to the home equity)	Equity level is lender dependent	No	Lender dependent	Market rate	Typically credit line drawn upon up to 10 years and repayment term up to 30 years (lender dependent)	Lender
Traditional Refinance	No restrictions	Lender dependent (less than or equal to the home equity)	Equity level is lender dependent	No	Lender dependent	Market rate	Typically up to 30 years (lender dependent)	Lender
Unsecured Home Loan	Energy & home improvements & renewables	Program dependent	Program dependent	Program dependent	Program dependent	Above market rate	Typically up to 20 years (program dependent)	Lender
EGIA GEOSmart	Energy improvements & renewables	Up to \$25,000	No	No	No	5.99 to 11.99% ²¹	Typically up to 10 years (loan amount dependent)	Contractor and/or lender

²⁰ HELOC- Home Equity Line of Credit

²¹ Current interest rates as of January 2011 (<http://www.egia.org/DesktopDefault.aspx?TabID=553>)

	Eligible Measures	Loan Limitations	Equity Req.	Down Payment Req.	Inspection Req.	Interest Rate	Term	Funding Source
Personal Loan	No restrictions	Lender dependent	No	No	No	Above market rate (lender dependent)	Typically up to 5 years (lender dependent)	Lender
FHA PowerSaver²²	Energy improvements & renewables	Up to \$25,000	No	No	Exterior inspection or other FHA accepted method	At or below market rate	Up to 20 years	Pilot Lender
Energy Star Mortgage²³	Energy improvements & renewables	Up to 15% of the home's appraised value	No	No	Home Performance with ENERGY STAR (HPwES) assessment	Market rate	Up to 20 years	Pilot Lender

²² A pilot program as of January 2011

²³ A pilot program as of January 2011

	Eligible Measures	Loan Limitations	Equity Req.	Down Payment Req.	Inspection Req.	Interest Rate	Term	Funding Source
Energy Performance Contracting	Energy improvements & renewables	Program dependent	Program dependent	Program dependent	Program dependent	Market rate	Typically between 10 to 15 years (program dependent)	Energy performance contractor
Revolving Loans	Energy improvements & renewables	Typically \$2,000 to \$10,000 (program dependent)	Program dependent	Program dependent	Program dependent	Typically below market rate	Typically up to 5 years (program dependent)	Lender
On-Bill²⁴ Financing	Energy improvements & renewables	Typically up to \$15,000 (program dependent)	Program dependent	Program dependent	Program dependent	Typically market rate	Typically up to 10 years (program dependent)	Utility provider
PACE²⁵	Energy improvements & renewables	Typically \$5,000 to \$75,000 (program dependent)	Typically 20% (program dependent)	Program dependent	Program dependent	Market Rate	Typically 5 to 20 years (program dependent)	Municipality

²⁴ Offered by some utilities – the loan payment is added to the monthly energy bill.

²⁵ Not accepted by housing authorities Freddie Mac and Fannie Mae, as of December 2013.

B. Gaps and Opportunities: Financing Option Evaluations

A number of gaps in the energy efficiency retrofit, solar PV and reroofing financing industries have been identified throughout this report. For some of the gaps, programs or pilots are underway or under evaluation for their ability to bridge these gaps. Other gaps are more fundamental and may require industry-wide effort efforts to overcome.

Each identified gap also presents an opportunity for further refinement, and financing and business model innovation. These gaps to financing energy efficiency, solar PV or reroofing in new or existing homes include:

- i. **Lack of information for homeowners regarding financing options: What are the available options and how do they compare against each other?**
- ii. **Long duration and complexity of financing application process**
- iii. **Predicting energy savings accurately: Inability to accurately and confidently forecast energy savings for residential retrofits remains an issue in many markets.**
- iv. **Valuing energy efficiency and solar PV upgrades in the real estate markets: The real estate market typically does not fully value energy efficiency measures, solar PV upgrades and homeowner energy savings in the assessment process for either new energy-efficient homes or energy-efficiency retrofits.**
- v. **Accurate valuation of solar PV in utility ratemaking cases and incentive programs. While the costs of solar PV are the focus of utilities and are understood generally, the same cannot be said for the value of solar. A national debate is underway about these values, including resiliency/security, market price impact, the value of energy, capacity generation impact and many other factors.**
- vi. **Multiple financing options confuse the homeowner: For reaching the California ZNE goals, participating in different programs for individual measures and improvements can be cumbersome for an individual homeowner. Sorting through the available options can be overwhelming to even the most committed homeowner interested in all available options.**

1. Lack of information for homeowners regarding financing options

This document represents an effort to directly address the lack of information issue. It will need to be updated as financing vehicles are improved and/or introduced. However, there is still a need to go beyond this guide and package the information in this guide for easy and simpler accessibility for the home owner, and to customize the information based on the audience's level of understanding and need for the information.

2. Long duration and complexity of financing application process

The federal government insures several of the financing options discussed in this guide to assuage lender uncertainty (risk) associated with energy efficiency and solar PV retrofit financing in the residential sector. By insuring the financing, the government essentially lowers the interest rate charged to homeowners for their loan or refinanced mortgage. The FHA 203(k), EEMs and HUD Title I loans are all backed by the government and were designed to meet the needs of homeowners interested in upgrading the energy efficiency of their homes and to encourage more homeowners to upgrade.

Although these programs have been mildly successful, they have not had significant impact on either the energy efficiency retrofit and solar PV industries or the financing industry. One of the main reasons these programs have not been more widely utilized by homeowners is that their application processes are often complicated and can regularly require months to complete. The protracted length of the process can confound an already complicated undertaking for many homeowners. In addition, the FHA 203(k) and EEMs are refinance or home purchase financing tools that require the complexity of a refinance even for homeowners who just wish to improve their home's energy efficiency. The result creates a gap between homeowners and financing for energy efficiency and solar PV retrofits.

The FHA *PowerSaver* pilot program mentioned in this guide designed to bridge this gap and offer loans to homeowners at market rates in what is hoped to be a less complicated, shorter application process. While currently only available as a pilot program in certain areas, *PowerSaver* aims to encourage lenders to finance energy efficiency retrofit loans by federally insuring up to 90% of the loan. The program specifically targets loans (not done as part of a refinance or home purchase) up to \$25,000 with terms as long as 15 years.²⁶ By decoupling the energy efficiency retrofit loan from the complexity and length required for a refinance, this program may be able to bridge an industry gap and encourage energy efficiency retrofits.

3. Predicting energy savings accurately

The assessment of associated risk with the loan is a means of determining whether or not a lender would lend money to an applicant, and then what interest rate would be charged to reflect the level of risk. Lending institutions assess the risk for making a loan by comparing actuarial data from large numbers of transactions to information regarding an applicant's income and expenses (and the loan's impact on them); if the income and expenses are not predictable, the level of risk involved in the loan increases. This type of historical data for energy efficiency and

²⁶ Loans for certain improvements can have terms of 20 years. For a press release and links to more information, please see: http://portal.hud.gov/hudportal/HUD?src=/press/press_releases_media_advisories/2010/HUDNo.10-251

solar PV loans does not currently exist for lenders, so the industry is forced to use other means to determine risk, set terms, and make energy efficiency loans.

Although energy efficiency and solar PV retrofits lower a homeowner's monthly expenses (by decreasing monthly utility bills) and computer modeling of the impact of energy efficiency and solar PV retrofits can be used to predict these savings, the data is limited and computer simulations, such as HERS ratings, are not widely understood or trusted by the lending industry; additionally, occupant behavior can cause significant variations in actual energy usage. Thus, the lenders need either more experience with energy efficiency and solar PV loans to build actuarial loan data, or strong government backing of loans based on HERS predictions to have strong loan-product offerings for energy efficiency and solar PV loans. Lenders' relatively low confidence in the predictability of energy retrofit effects on energy consumption and utility bills translates to uncertainty about an applicant's monthly expenses, increasing perceived risk. The increased risk often results in higher interest rates or a denial of funding. A significant gap is created as the utility bill savings are not accounted for and homeowners are not connected with attractive financing, or are offered financing at above market interest rates.

As discussed earlier, inaccurate energy savings forecast can be detrimental to municipal and utility financing programs which are structured to be cash-flow neutral or positive so that electricity savings are equal to or greater than the cost of the loan. There could be a risk of the actual electricity savings not being able to offset the financing costs.

In the commercial, industrial and municipal building sectors, occupancy, behavior, and usage patterns are known to be predictable based upon the building's use. For example, an office building will likely be regularly and predictably occupied from 8 a.m. to 6 p.m., with accurately predictable energy use. This predictability of an office building's heating and cooling, lights and other energy uses are becoming even more predictable as these energy using systems are increasingly being controlled more accurately through the increased use of energy management systems. The predictability of energy use in commercial, industrial, and municipal buildings has led to the growth of both energy performance contracting (EPC) and power purchase agreements (PPAs) in these sectors. Although all financing options for residential energy efficiency retrofits would benefit from increases in the predictability of energy savings, EPC and PPAs are especially dependent upon this predictability.

These two financing tools are basically agreements between a contractor/financer and a building owner that the energy and utility bill savings from an energy efficiency retrofit will be greater than the monthly cost of the financing. In effect, the contractor is betting (and guaranteeing) that the utility bill savings will satisfy a guaranteed level of savings made to the property owner. If energy savings from energy efficiency retrofits in residential buildings can be more accurately predicted, EPC and PPAs might be more widely available to homeowners, bridging a major gap in financing retrofits.

The lack of predictability in homes could be substantially mitigated by improved home energy management systems that could provide good and consistent scheduling of energy use, and the capability of turning off or setting to standby, electric systems that are on but not being used. While possibly not having the consistency of a commercial building, the occupants of commercial buildings are also the occupants of their homes, and those people typically live and work on regular schedules. This all points to the need for easy to install and use, cost-effective home energy management systems.

4. Valuing energy efficiency and solar PV upgrades in the real estate markets

The fourth gap in financing energy efficiency retrofits for homeowners – properly valuing efficiency and solar PV improvements in local real estate markets – is complex and may require changes in the residential building sector. Currently, loans are made to homeowners for improvements to their homes for work that will have a predictable impact on home value and expenses. Homeowners' income includes their investments, of which the home is generally the largest. If a homeowner would like to remodel the kitchen and add a deck to the rear of the house, a lender can turn to an appraiser to calculate the increase in the value of the home that will result from the improvements using the appraisal industry practices and rules based on long experience and historical data. The increase in home value translates to a future increase in income for a homeowner and results in a predictable level of risk for the lender.

Until very recently, the appraisal industry has not had a similar set of industry-vetted policies and practices for valuing energy efficiency and solar PV.. Without a method to calculate the increase in the value of the home, lenders have difficulty regarding how to consider the lower utility bills and their value to future homebuyers when underwriting loans to homeowners. Despite technical data provided by home energy inspections, solar companies and reports that documents the expected energy and cost savings, often the underwriting criteria does not reflect the lower risks associated with these savings. Presumably, as the appraisal industry is educated, and appraisers are certified in the new procedures for valuing energy efficiency and solar PV, lenders will begin to properly value the costs and benefits of the energy improvements, increasing the market for energy efficiency improvements.

Lenders and appraisers will directly benefit from the new policies and procedures recently adopted by the National Appraisers Institute, providing them with a mechanism for energy efficiency improvement valuation. The institute has also introduced a new addendum for appraising green features in homes – “Residential Green and Energy Efficiency Addendum”²⁷. Furthermore, the appraisal industry has begun to recognize this issue and has recently developed

²⁷ URL: http://www.appraisalinstitute.org/education/green_offerings.aspx

several courses and seminars as well as a green certificate program for appraisers who want to qualify for energy efficiency valuations. Substantial work needs to be further done to include energy efficiency in assessors' valuation of homes, so that the homeowners and their efforts are recognized, rewarded and given the appropriate credit for upgrading to higher energy efficiency features and installing solar PV systems.

5. Accurate valuation of solar PV in utility ratemaking cases and incentive programs

Financing vehicles and loans and the people that manage them rely on legislation, regulations and local ordinances often, and the resulting price signals sent to the market—and the market responds by reacting to these signals. Many states, including California, Colorado, Georgia and Minnesota are currently wrestling with quantifying the true value of solar energy. The costs of solar PV have been the primary focus of utilities and regulators and are understood generally, due to the fact that net metering laws are in place in 43 states. Public utility commissions routinely work on these costs with utilities as part of rate making schemes and incentive programs. However, the same cannot be said for the “value” of solar. The value of solar can include many factors, such as price avoided emissions, hedge value, avoided capacity, avoided energy, deferred capital, avoided line losses, increased resiliency and economic development benefits. *These values are under debate right now, and the results of the debate will impact near- and long-term financial products offered to homeowners.*

Net metering laws and regulations are under attack in many states by utilities arguing that solar customers are not paying their fair share of using the grid, while pointing out the cost of solar installations is falling dramatically. For example, average solar PV system prices have declined by 40-percent since the beginning of 2011 – and by more than 50 percent since the beginning of 2010.²⁸ Solar advocates point out the values and benefits listed above, and are asking that they be valued and calculated now for the first time in many places as part of utility rate cases.

The authors point this out here because we believe that there may be a substantial time period where the value of solar and net metering laws are studied in 2014-5. *As a result, financial markets may be stymied due to relative uncertainty in the market as they try to develop new solar PV financing products.* This possibility is characteristic of the past “boom and bust” cycles defining the solar energy over the last 40 years, as federal research and development to solar energy endured periodic budget cuts.

²⁸ <http://www.treehugger.com/energy-policy/california-energy-bill-protect-net-metering-boost-renewable-energy-state.html>

With the current net metering system set to expire in 2014 in California, the California legislature in late 2013 passed AB327, a new law that directs the California Public Utilities Commission to design a new net metering program that would take effect in 2017 and also gives the regulator the authority to require utilities to source more than 33 percent of their power from renewable sources like wind and solar. This legislation addresses California, but many other states may be in limbo in the coming year.

6. Multiple financing options confuse the homeowner

A homeowner can be overwhelmed by the multiple financing options available today, particularly to achieve a Zero Net Energy (ZNE) home requiring financing of the identified goals – high energy efficiency upgrades and solar PV.

For example, in California alone there are a number of local, state and federal and utility driven rebates and incentives available for the customer to partake, depending on their location, city and their utility.. These rebates and incentives are dependent on the homeowner's requirements – equipment replacement, energy efficiency upgrade or installation of solar on the roof. It is very easy for the homeowner to spend several hours researching energy efficiency and solar PV rebates and incentives on the Internet. Add phone and personal interviews of contractors, and the homeowner can invest a total of one day on research alone. This research can benefit from a “one-stop” location and a comprehensive approach to ZNE financing. In addition, financing packages need to be easy to identify and tap before true market penetration can occur.

C. Conclusions

It is important that a homeowner reviews and understands all available financing options so that they can select the most appropriate option relative to their needs. Every financing program has advantages, disadvantages, and limitations. While some programs might offer below market interest rates, there will most likely be limitations in the form of other underwriting criteria including allowable measures, maximum loan amounts, and home audit, equity, and down payment requirements.

Each energy efficient and solar PV retrofit project is unique and, consequently, not all financing programs will be appropriate. Once a homeowner is interested in making energy improvements, financing can make the investment possible and affordable.

Key Concepts to Consider²⁹

When evaluating different options for financing energy efficiency and solar PV, to properly evaluate the different financing options and to develop an optimized retrofit strategy and plan for reducing the grid-energy used by a home coupled with the best financing option the following key concepts need to be considered:

- Consider the long term costs and benefits that will accrue over the entire life cycle of a system or the piece of equipment
- Take advantage of a home energy inspection to provide key data for making energy improvement decisions, request the following results from the inspection for evaluating the investments from the possible improvements:
 - Energy efficiency improvements, in order of cost-effectiveness, tailored to the home
 - Potential saving from the improvements
 - Potential costs of the improvements
 - Economic analyses of packages of features, including cash-flow and/or lifecycle cost analyses
- Include direct and indirect benefits in the cost-effectiveness analyses
 - Consider not only the energy savings, but also the improvements in household comfort with energy efficiency improvements and reliability improvements that result from the addition of solar PV
- Leverage energy efficiency and solar PV retrofits to achieve multiple goals
 - Determine the goals of the retrofit before obtaining a financing product
 - Goals can include: cost savings, energy independence, improved energy reliability, paying off personal debt; obtaining sustainable, whole-house comfort; minimizing home maintenance; air quality improvement and climate mitigation. .

²⁹ These Key Concepts are also listed in the introduction

- Consult with local lenders and review energy efficiency of the efficiency improvements and the solar PV retrofit financing programs
- Know that both the energy efficiency and solar PV equipment have limited and predictable lifespans
 - Be prepared for potential systems failures (e.g., furnaces, water heaters, etc.) by knowing the typical life of important equipment³⁰
 - Store and use this information as a triggering event to simultaneously:
 - Replace old, inefficient systems that are at the end of their useful lives
 - Hire a home energy rater before the equipment fails to garner information needed to do efficiency and solar PV upgrades, optimizing time, and energy and bill savings, and minimizing inconveniences
- Know that low interest rates are available through financing products which may require more paperwork and longer processing times
- Know that making multiple upgrades at the same time is almost always more cost-effective than making them separately:
 - Consider at least all of the upgrades that will result in a neutral cash flow (where monthly payments for improvements at least equal the monthly utility savings).
- Keep in mind that the home value can increase after an energy efficient retrofit and solar PV installation
 - Obtain an energy efficient home value appraisal from an appraiser certified under National Appraisal Institute as a “green” appraiser.

³⁰ NREL’s lifecycle database for the expected operable life of various building system:
<http://www.nrel.gov/lci/database/default.asp>

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Appendices

Appendix A

i. Sample Calculations: EEM Buying Power

With the same monthly income (e.g., \$5,000), a buyer can qualify for a larger loan (e.g., \$28,600 more) with an EEM due to the increased debt-to-income ratio.

For a standard home without energy improvements:	
Buyer's total monthly income	\$5,000
Maximum allowable monthly payment 29% ³¹ debt-to-income ratio	\$1,450
Maximum mortgage at 90% of appraised home value	\$207,300

For an energy-efficient homes:	
Buyer's total monthly income	\$5,000
Maximum allowable monthly payment 33% ³² debt-to-income ratio	\$1,650
Maximum mortgage at 90% of appraised home value	\$235,900
Added borrowing power due to the Energy Efficient Mortgage:	\$28,600

*Interest rate 7.5%, down payment of 10%, 30-year term, principal & interest only (tax & insurance not factored.)

³¹ This is a standard debt-to-income ratio, but can vary.

³² This is a typical debt-to-income ratio for an EEM; it also can vary but should be 2-4 percentage points higher than for a standard loan.

Sample Calculation: EEM Monthly Cost Savings

The true cost of home ownership (i.e., cash flow) for an energy efficiency home can be less than the true cost of home ownership for a comparable home. While the energy efficient home price is higher than an older home, the reduced utility bill cost offsets the energy improvement costs, resulting in total monthly savings for the energy efficient homeowner.

	Older Existing Home	Same Home with Energy Improvements
Home price (90% mortgage, 8% interest)	\$ 150,000	\$ 154,816
Loan amount	\$ 135,000	\$ 139,334
Monthly payment	\$991	\$1,023
Utility bills	+ \$186	+ \$93
The true monthly cost of home ownership	\$1,177	\$1,116
Monthly savings		-\$61

*Interest rate 7.5%, down payment of 10%, 30-year term, principal & interest only (tax & insurance not factored.)

Sample Calculations: EEM with Utility Bill savings as Additional Homeowner Income

In addition to providing an increased debt-to-income ratio, typically an EEM will include the expected utility bill savings from the energy improvements in the buyer's total income.

For a standard home without energy improvements:	
Buyer's total monthly income	\$5,000
Maximum allowable monthly payment 29% ³³ debt-to-income ratio	\$1,450
Maximum mortgage at 90% of appraised home value	\$207,300

For an energy-efficient home:	
Buyer's total monthly income	\$5,000
Buyer's total monthly income with utility bill savings	\$5,093
Maximum allowable monthly payment 33% ³⁴ debt-to-income ratio	\$1,681
Maximum mortgage at 90% of appraised home value	\$240,420
Added borrowing power due to the Energy Efficient Mortgage:	\$33,120

*Interest rate 7.5%, down payment of 10%, 30-year term, principal & interest only (tax & insurance not factored.)

³³ This is a standard debt-to-income ratio, but can vary.

³⁴ This is a typical debt-to-income ratio for an EEM; it also can vary but should be 2-4 percentage points higher than for a standard loan.

Appendix B

FHA Traditional 203(k) and Streamline 203(k) Loan Eligible Improvements List³⁵

Eligible Improvements under Both Traditional and Streamline 203(k) Programs:

- Repair/Replacement of roofs, gutters and downspouts
- Repair/Replacement/upgrade of plumbing and electrical systems
- Repair/Replacement of flooring, tiling and carpeting
- Remodeling, such as kitchens and bathrooms
- Repair/replace/add exterior decks, patios, porches
- Basement finishing and remodeling
- Basement waterproofing
- Septic System and/or well repair or replacement
- Lead-based paint stabilization
- Accessibility improvements for persons with disabilities

Eligible Energy Efficient Improvements under Both Traditional and Streamline 203(k) Programs:

- Repair/Replacement/upgrade of existing HVAC systems
- Weatherization, including storm windows and doors, insulation, weather stripping
- Window and door replacements and exterior wall re-siding
- Purchase and installation of appliances, including free standing ranges, refrigerators, washer/dryers, dishwashers and microwave ovens

Additional Eligible Improvements under the Traditional 203(k) Program Only

- Major rehabilitation/Repair, such as relocation of load-bearing walls
- Room additions
- Repair of structural damage
- Repairs requiring detailed drawings or architectural exhibits
- Landscaping or similar site improvements including: terraces, correction of grading and drainage problems, tree removal if the tree is a safety hazard, repair of existing walks and driveways if a safety hazard, fencing, new walks and driveways and general landscaping work

³⁵URL: <http://www.hud.gov/offices/hsg/sfh/203k/203kslrp.cfm>

Appendix C

List of Eligible Measures under the *PowerSaver Pilot Program*³⁶

Improvement	Standards
Whole House	<p>Whole house air sealing measures, including interior and exterior measures, utilizing sealants, caulks, insulating foams, gaskets, weather-stripping, mastics, and other building materials in accordance with BPI standards or other procedures approved by the Secretary.</p> <p>(BPI Reference: http://www.bpi.org/standards.aspx)</p>
Insulation: Attic	<p>Attic insulation measures that:</p> <p>(A) Include sealing of air leakage between the attic and the conditioned space, in accordance with BPI standards or the attic portions of the DOE or EPA thermal bypass checklist or other procedures approved by the Secretary;</p> <p>(B) Add at least R-19 insulation to existing insulation;</p> <p>(C) Result in at least R-38 insulation in DOE climate zones 1 through 4 and at least R-49 insulation in DOE climate zones 5 through 8, including existing insulation, within the limits of structural capacity, except that a State, with the approval of the Secretary, may designate climate zone sub regions as a function of varying elevation; and (Map Page: http://www.energystar.gov/index.cfm?c=home_sealing.hm_improvement_insulation_table)</p> <p>(D) Cover at least:</p> <p>(i) 100 percent of an accessible attic; or</p> <p>(ii) 75 percent of the total conditioned footprint of the house.</p> <p>(BPI Reference: http://www.bpi.org/standards.aspx)</p>
Insulation: Wall	<p>Wall insulation that:</p> <p>(A) Is installed in accordance with BPI standards or other procedures approved by the Secretary;</p> <p>(B) Is to full-stud thickness or adds at least R-10 of continuous insulation; and</p>

³⁶ URL: <http://www.federalregister.gov/articles/2010/11/10/2010-28015/federal-housing-administration-fha-notice-of-fha-powersaver-home-energy-retrofit-loan-pilot-program#h-48>

Improvement	Standards
	<p>(C) Covers at least 75 percent of the total external wall area of the home.</p> <p>(BPI Reference: http://www.bpi.org/standards.aspx)</p>
Insulation: Crawl Space	<p>Crawl space insulation or basement wall and rim joist insulation that is installed in accordance with BPI standards or other procedures approved by the Secretary and:</p> <p>(A) covers at least 500 square feet of crawl space or basement wall and adds at least:</p> <p>(i) R-19 of cavity insulation or R-15 of continuous insulation to existing crawl space insulation; or</p> <p>(ii) R-13 of cavity insulation or R-10 of continuous insulation to basement walls; and</p> <p>(B) Fully covers the rim joist with at least R-10 of new continuous or R-13 of cavity insulation.</p> <p>(BPI Reference: http://www.bpi.org/standards.aspx)</p>
Duct Sealing	<p>Duct sealing or replacement and sealing that:</p> <p>(A) Is installed in accordance with BPI standards or other procedures approved by the Secretary; and</p> <p>(B) In the case of duct replacement and sealing, replaces and seals at least 50 percent of a distribution system of the home.</p> <p>(BPI Reference: http://www.bpi.org/standards.aspx)</p> <p>(Reference: http://www1.eere.energy.gov/buildings/windowsvolumepurchase/)</p>
Skylight Replacement	Skylight replacement that meets most recent Energy Star specifications.
Door Replacement	Door replacement that meets most recent Energy Star specifications.
Storm Doors	<p>Storm doors that:</p> <p>(A) Meet the most recent Energy Star specifications</p>
Storm Windows	<p>Storm windows that:</p> <p>(A) Meet the requirements for low-e storm windows under the Department of Energy Windows Volume Purchase Program</p>

Improvement	Standards
Heating System Gas/Propane/Oil Boiler/Furnace	Heating system replacement that meets most recent Energy Star specifications.
Air Conditioner	http://www.federalregister.gov/articles/2010/11/10/2010-28015/federal-housing-administration-fha-notice-of-fha-powersaver-home-energy-retrofit-loan-pilot-program#h-48
Geothermal	http://www.federalregister.gov/articles/2010/11/10/2010-28015/federal-housing-administration-fha-notice-of-fha-powersaver-home-energy-retrofit-loan-pilot-program#h-48
Water Heater(gas, propane, electric, tank less)	Replacement of a natural gas, propane, or electric water heater that meets most recent Energy Star specifications.
Water Heater (solar)	Solar water heating property must be Energy Star Qualified, or certified by the Solar Rating and Certification Corporation or by comparable entity endorsed by the state in which the system is installed.
Fuel Cells and Micro turbine Systems	Efficiency of at least 30% and must have a capacity of at least 0.5 kW.
Solar Panels (Photovoltaic Systems)	Photovoltaic systems must provide electricity for the residence, and must meet applicable fire and electrical code requirement.
Wind Turbine Residential	A wind turbine collects kinetic energy from the wind and converts it to electricity that is compatible with a home's electrical system, and has a nameplate capacity of no more than 100 kilowatts.
Roofs Metal & Asphalt	Metal or asphalt roofs that meet most recent Energy Star specifications.